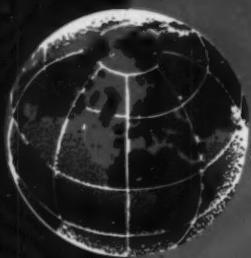


NOVEMBER 1957 VOL 19 NO 12

MINING WORLD

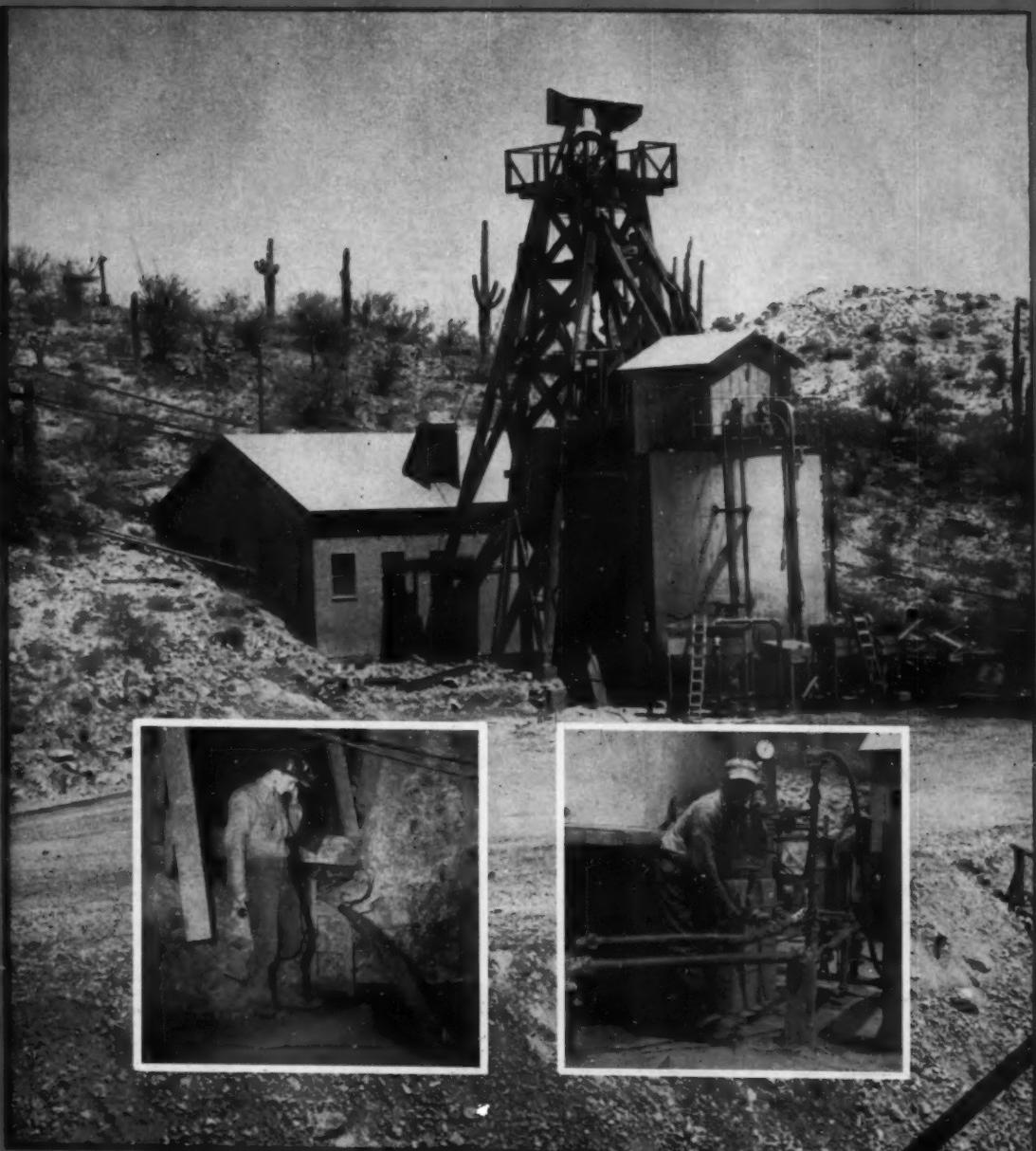


Underground Mill Beats

Greenland Weather Page 46

Structural Clues For

Crooks Gap Uranium Page 54



Hydraulic Fill For Banner's Stopes

Page 38

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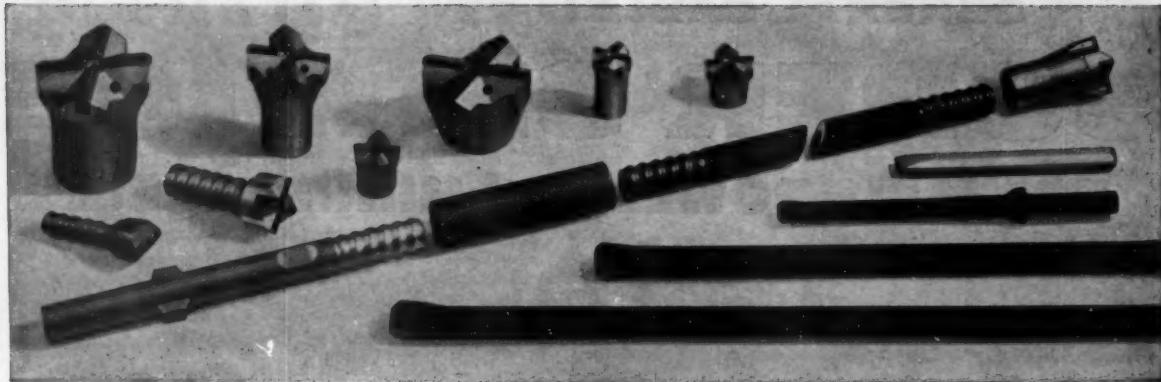
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Sandvik Coromant integral steels have up to 50% longer rod life than ordinary steels, thanks to anti-corrosion SR-treatment, which protects them during transport, storage and actual drilling. In addition, air-tight plastic caps give bit and shank extra protection during transport and storage. They are available in these standard sizes:—

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Flexible drill steels	2'7"-31'6"

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The threads of Sandvik Coromant (cross and X-design) bits are precision milled. The bits are so accurately manufactured that not only smoother drilling but *longer life* are ensured. Standard bit diameter sizes range from $1\frac{1}{2}$ " to $4\frac{1}{2}$ ". The 773 bits (bottoming type) are available with GD400

and GD600 thread, or with $1\frac{1}{4}$ ", $1\frac{1}{2}$ " and 2" rope thread. The 776 bits, for standard shoulder-type drill rods, are available with threads ranging from $\frac{7}{8}$ " to $1\frac{1}{16}$ ".

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Mining World

Including the Export Edition WORLD MINING

Published monthly except in April when publication is semi-monthly

VOLUME 19

NOVEMBER 1957

NO. 12

OPERATIONS—TECHNOLOGY

Mining & Metallurgy

- Banner's Arizona Copper Developments 38

Detailed geology and exploration has led to development of three copper properties in the Pima and Twin Buttes district south of Tucson. Recent installation of a hydraulic sand fill plant favors abandonment of shrinkage stoping for cut-and-fill methods.

- Underground Mill Beats Greenland Weather 46

By P. H. FAHLSTROM AND BERTIL ASTLIND

One of world's most northerly mines can't shrinkage stope because of weak hanging wall and danger of ore freezing in stopes. The 360-ton mill and power plant were installed underground where wall rock temperatures approximate 34° F. The only evidence a visitor can see of an active lead-zinc operation is an exhaust chimney, dumps, an oil tank and a growing stockpile of sacked concentrates.

- Pellet Hardening Method Uses Grate and Kiln 59

Objective of this new grate and kiln process developed by Allis Chalmers Manufacturing Company is to convert pelletized magnetite to a hard, durable product.

Geology

- Structure Yields Clues to Crooks Gap Uranium 54

By CHARLES E. MELBYE

The district is situated on or near an echelon anticlines trending southeast or northwest from the major Sweetwater Arch. All known deposits either fall on the crests or on flanks of major or minor anticlines.

Book Review

- The Porphyry Coppers in 1956 45

By A. B. PARSONS

The second edition of Porphyry Coppers covers the period from 1932, where the first edition left off, to the autumn of 1956.

Conventions

- Uranium Reduction Dedicates New Moab Plant 43

Uranium Reduction Company holds ceremonies dedicating the second largest uranium mill in the United States. The emergence of this country as the world's leading uranium producer and the Moab plant can be traced back to Charles Steen's original Mi Vida discovery.

- Leading Metallurgists Attend Stockholm Meeting 51

By MAX F. HOLINGER

Qualified observers, including those from the United States, consider the September International Minerals Dressing Conference in Stockholm as one of the most profound and productive meetings ever conducted in the field of mining and metallurgy.

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ON THE COVER

At Banner Mining Company's Arizona operations, a hydraulic-fill batching plant has favored substitution of cut-and-fill stoping for shrinkage stoping. Communication between 2-man fill crew is by telephone.

READERSHIP


RESEARCH



MILLER FREEMAN PUBLICATIONS

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Merle E. Hanson has operated other graders, and he says:

"THE NO. 12 HAS ALWAYS BEEN MY FAVORITE MACHINE"



This Caterpillar No. 12 Motor Grader maintains two miles of 40-foot haul road at an open pit copper mine near Butte, Montana. On the job 8 to 16 hours per day, 6 days a week, this hard-working machine has the enthusiastic approval of its operator, Merle E. Hanson.

"The No. 12 has always been my favorite machine," he says. "I've operated other makes of graders and have had a chance to compare. The No. 12 has good visibility and is easy to handle. It has always taken less adjustment and less repairs than any other machine."

Other Caterpillar-built machines are also on this Anaconda Company operation. Four D8 Tractors and two D6 Tractors are removing overburden and copper ore. The F & S Contracting Co. of Butte, and the Morrison-Knudsen Co. of Boise, Idaho, have a joint contract from The Anaconda Company to do a limited amount of work on this ore body.

Already known as the "standard of the industry," the No. 12 has pulled even further ahead of the field

with its *exclusive* new Preco Automatic Blade Leveler, which makes it possible to control slopes within $\frac{1}{8}$ " in 10' width. Other important features of the No. 12: powerful CAT* Diesel Engine; long radius, curved side shift rack that allows a full range of blade positions without changing links or adjusting the blade; tubeless tires — which reduce tire down time as much as 80%; and long-life oil clutch.

In addition to the No. 12, there are two other motor graders in the Caterpillar line: the No. 112 and the No. 212. Let your Caterpillar Dealer demonstrate the one best suited to *your* needs on *your* operation. You can count on him for expert, reliable service—and parts you can trust.

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Drifts and Crosscuts

Make Your Nominations Now

There have been important and significant developments in all sections of the minerals industries in 1957. As the year draws to a close, MINING WORLD editors ask for your suggestions and nominations for the following awards:

- The Underground Mine of the Year
- The Open-Pit Mine of the Year
- The Outstanding Small Mining Company of the Year
- The Technological Achievement of the Year in the Industry
- The Man of American Mining of the Year

Please send your nominations to the editors today. Your recommendations will be confidential.

Mining World at Stockholm Conference

It was a real pleasure and distinct honor to have MINING WORLD the only United States technical publication at the recent International Mineral Dressing Congress in Stockholm, Sweden. And MINING WORLD and its international edition WORLD MINING were widely known and carefully read by many of the delegates who attended from 33 countries. Americans played an important part in presenting a series of technical papers, reports Max F. Holsinger, general manager, directly from the meeting; for further details see his report on page 51.



This Ge-Be photograph shows P. G. Kihlstedt (left), professor of metallurgy at the Swedish Royal Institute and general conference chairman, talking to Mr. Holsinger, and W. B. Stephenson, member of the Honorary International Committee, and president of the Allen-Sherman-Hoff Pump Company.



MILLER FREEMAN PUBLICATIONS



"SHEAR-BALL" TURNTABLE MOUNTING*

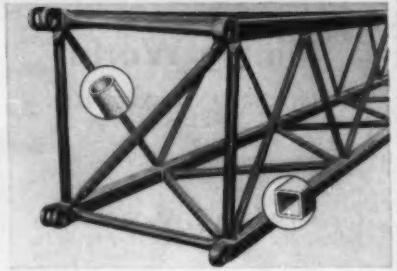
Turntable is secured to crawler and revolves easily and freely on a huge sealed "ball bearing." No center pin or nut, centering gudgeon or exposed roller path . . . no turntable rollers . . . no constant adjustment, maintenance or lubrication problems.

*U.S. and foreign patents applied for.



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The newest and most effortless of all shovel-crane power controls. "Metered Air" feeds power to clutches at any rate desired—yet operator retains full "feel" of all operations. Fewer levers, fewer motions, faster, smoother, less effort, less fatigue, more output.



SQUARE-TUBULAR-CHORD BOOM*

This new patent-applied-for design has startling advantages over conventional types. Reduces weight and increases lifting capacities. 30-ton crane capacity on 14-ft. long x 13-ft. wide crawlers . . . up to 100-ft. boom, plus tip extensions available.

In the LORAIN-56 too the **BIG 3**
make money for you!



Just like the big 2½-yd. Lorain-85A, the fully convertible 1¼-yd. Lorain-56 gives you the 3 big Lorain features that will mean more profits on any job. You get greater operating ease, longer life, higher production, reduced maintenance . . . plus increased crane capacities with these "Big 3" features.

There are many other "56" advantages, too, that make it an exceptional value in the 1¼-yd. class. Here are a few: full air control of crawler operations . . . hoist and swing drums and travel shaft on anti-friction bearings . . . torque converter power take-off . . . choice of two crawlers . . . crane capacities up to 30 tons available . . . a new, interchangeable hoe with dipper widths from 36" to 48" . . . and there are many more.

We would like you to know *all* about the Lorain-56. Why not see your nearby Lorain Distributor now—or write direct for the information you need.

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MANUFACTURERS OF POWER SHOVELS, CRANES,
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THE THEW SHOVEL CO., LORAIN, OHIO

MINING WORLD NEWSLETTER

Germany . . . Arizona . . . Outer Space

November 1957

Greater productive efficiency is the order of the day.

Closer liaison between mine operators and manufacturers is receiving increasing emphasis in order to develop more efficient equipment and to increase tons per man shift. This is at least one step toward solving the twin problems of increased labor costs and dwindling profit margins.

The Range Mechanical Committee is typical of this closeness of operation. Representatives of Mesabi Iron Range mining firms meet with manufacturers to promote advancements in design with emphasis on standardization, interchangeability, and simplification of design for maintenance and cost purposes.

Look for formation of similar committees to tackle other production problems.

New German equipment and process techniques are also being scrutinized more closely by U.S. mining firms. MINING WORLD's General Manager, Max F. Holsinger, on location in Europe, notes particularly these developments:

Direct reduction of low-grade ores to sponge "luppen" iron continues to make headway with Krupp's new Renn process. Negotiations are underway for a plant to treat iron ore from a promising western U.S. deposit.

The first U.S. low-frequency electric furnace for high-purity reduction melting of electrolytic zinc is being installed at Anaconda Company's Montana facilities by Demag engineers. The 1,000-kva, 600-kv unit will have a load capacity of 28 short tons with an output of 150 tons daily. Lectromelt Furnace of Pittsburgh is a recent cross-licensee.

The wheel-type excavator, supplied by Orenstein-Koppel of Lubeck, is being studied for possible application in a major California open-pit mine.

Mining mystery of the month: What has all of the extensive drilling in the southeastern section of Arizona disclosed?

At least two major copper producers are reported to have drills in the area.

Copper, lead, and gold have all been found here in the past.

Most drilling seems to be on the Lone Star, North Star, and Kirtland Hill groups north of Safford, and west of Phelps Dodge's Morenci mine. Some holes are as deep as 1,400 to 2,000 feet into a monzonite stock.

What's your guess—how big is the deposit and how involved is the metallurgy?

Have you considered what Sputnik means to the mining industry?

Not much at first glance, because there isn't much metal in the 184-pound aluminum sphere besides alloy steel radio components (and possibly tungsten alloys since it is so heavy).

On second look, though, there is more mining in Sputnik than you think.

A mined fuel, possibly boron-based, was needed to get the satellite into outer space.

Super alloys were required for the three-stage rocket—columbium, nickel, molybdenum, tungsten, cobalt, and perhaps others.

The U.S. counterpart, the Vanguard, is reported to have magnesium casing plated with gold. Good news for the gold miners, too?

HOW ST. PATRICK'S COPPER MINE MOVES 1½ MILLION TONS OF ROCK A YEAR



ON ITS WAY OUT OF THIS MINE, a huge Caterpillar DW21 Wheel Tractor stops to have its picture taken—for here it is helping to make mining history.

At St. Patrick's Mine near the village of Avoca in County Wicklow, Ireland, four 30-ton units are operating *underground*—first machines of their size ever to do so, anywhere in the world.

The machines are CAT* DW21s (Series C). They're hauling earth and rock from inside the mine tunnel to an outside dumping area. The tunnel is 17 ft. high, 16 ft. wide, and when it is finished it will run 8,000 ft. at an 11% slope. In and out of this tunnel roll the mighty DW21s, each hauling an Athey PR21 rubber-tired rear dump trailer with 34-ton load.

When the haulage-way is completed, St. Patrick's will work three ore bodies—which are at different levels—in one 20-year program. 1½ million tons of rock will come out of the ground here each year, on the fast-moving wheels of St. Patrick's 300 HP (maximum output) Caterpillar DW21 Wheel Tractors.

How are the DW21s doing on this history-making assignment? "They are easy to handle," reports

transport foreman Phelim Doyle. "I would like to have ten more." Operator Thomas Doyle agrees: "It's easy to steer, and it has plenty of power."

Your Caterpillar Dealer will give you complete information on this remarkable unit. For example, special exhaust scrubbers are available for the DW21's engine for underground work. Ask him about its performance on any kind of stripping or hauling job. Call on him, too, for expert service—and for replacement parts you can trust.

Caterpillar Tractor Co., San Francisco, Calif.; Peoria, Ill., U.S.A.

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ONE GOAL: To concentrate our capabilities, resources and experience on the design, manufacture, distribution and service of job-tested heavy equipment.



Capitol Concentrates

Engle Bill To Restrict Military Grabs Of Public Land Almost Passed Congress

The Engle bill to curb military withdrawals of public lands rested on the desk of the Speaker of the House when Congress adjourned. In passing the bill on August 20, the Senate amended it with respect to specific lands in Nevada. Because of House objections to the Senate amendments, and the short time remaining before adjournment, no move was made to refer the bill to a joint Senate-House conference committee.

This bill would provide that withdrawals of public lands exceeding 5,000 acres for one defense department facility can be made only by act of Congress; and that all military withdrawals (except lands reserved for naval oil or coal) are subject to the conditions that all minerals, including oil and gas, in the lands so withdrawn or reserved are under the jurisdiction of the Secretary of the Interior and must be disposed of under the applicable mining and mineral leasing laws, except where the Secretary of Defense determines that such use would be inconsistent with the military use of the lands.

• Tungsten Investigation Will Be Made

The Tariff Commission is making preliminary arrangements for the tungsten investigation authorized by Senate Resolution 195. This is the resolution which directed the commission to make a study of the differences in the cost of production of foreign tungsten ores and concentrates and those produced from domestic deposits.

The commission is expected to give 30 days' notice when a definite date for public hearings has been set. At that time industry witnesses will be given an opportunity to present testimony. Upon completion of the investigation, the Tariff Commission will file a formal report with the Senate. The resolution provided that the report must be filed no later than March 1, 1958.

• Silver Act Repeal Is His Goal

Rear Admiral Donald J. Ramsey, (USN, retired), is continuing his campaign for repeal of all silver legislation. He recently addressed the National Advisory Council of the American National Retail Jewelers Association, and advocated the repeal of three laws "to give us a free and open market" for silver.

The measures Ramsey would repeal are the act of 1934, providing that the Secretary of Treasury shall purchase all silver at home or abroad until the Treasury has accumulated an amount equal to one-quarter of the value of the United States gold and silver monetary stocks; the act of 1939, requiring the Treasury to accept all domestically produced sil-

ver; and the amendment to the 1939 act which (in 1946) set the price to be paid at 90.50 cents an ounce.

Ramsey insists that the laws were passed as monetary laws under the pretense that silver was standard money as well as gold. As a result, he says, the Treasury shows on its books that about 2,000,000 ounces of silver are worth about \$2,500,000, when actually the market price of the metal, "its only real value," is about \$1,800,000.

• Escalation for "Peril Point" Suggested

No program for mining is long-range if it must go back to the Congress or to government agencies for periodic readjustments of key parts. In an effort to avoid this difficulty, the Murray-Baring bill (S. 2581) ties the "peril points" to the Bureau of Labor Statistics price index of nonferrous metals so that they will escalate according to the cost of production. Advocates of the plan say it is strange that neither the copper nor the lead-zinc industry has put this feature into one of the industry-supported bills. They believe it would apply satisfactorily either to a tariff or a quota bill which included the "peril point" idea.

• Breaks Applied to Accelerated Amortization

During the closing days of the last session of Congress, H. R. 232 became Public Law 165. This is the measure which limits the issuance of five-year tax amortization certificates to facilities (1) for producing new and specialized defense items for the Defense Department and Atomic Energy Commission, and (2) for providing research, development, or experimental services for such agencies. It also sets December 31, 1959, as the termination date for the entire accelerated tax amortization program.

• U. S. Opposes Rise in Gold Price

Undersecretary of the Treasury, W. Randolph Burgess, temporary alternate governor for the United States at the 12th annual meeting of the Board of Governors of the International Monetary Fund, laid the administration's gold policy right on the table at its recent Washington, D. C. meeting. He said, "The United States is resolved to check inflationary pressures existing in its economy. We are equally resolved to preserve our international gold bullion standard. The dollar has traditionally been linked to gold, and it is our policy to keep it firmly linked to gold at \$35.00 per ounce."

Meanwhile, the long authorized study of the Monetary Fund with respect to the desirability of increasing the price of gold has not been issued, nor, in all probability, will it soon be. Apparently it is kept on ice in case circumstances require the fund to move with appropriate justification.

ENGINEER'S FIELD REPORT

PRODUCT CHEVRON VISTAC OIL

NEVADA-MASSACHUSETTS
COMPANY

FIRM Tungsten, Nevada

Special Oil holds wear to minimum for 15 yrs.



Nevada-Massachusetts Co., operators of one of the world's largest tungsten mines, has relied on Chevron Vistac Oil for 15 years, to keep their rock drills and other air tools operating at peak efficiency. "We use Vistac because it stays on the tools whether they're wet or dry. Doesn't create drag, either...we get full power with minimum tool wear," says general manager Eldridge Nash. Oil's tough, protective film resists high operating temperatures, helps

this firm's rock drills (above) bore fifteen 2½-inch blasting holes averaging twelve feet in depth, in just eight hours. Nevada-Mass. does extensive underground mining at this site as well as surface operations.



TRADEMARKS "CHEVRON," "VISTAC" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

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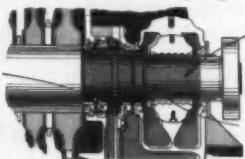


Despite heavy abrasive dust from drilling in Hornfels and Scheelite, (above), Chevron Vistac Oil keeps rock drills working smoothly. Lubricant is used in 60 rock drills, 3 wagon drills, plus 25 tuggers (air motors) on hoist equipment, loaders, slusher hoists and sump pumps.



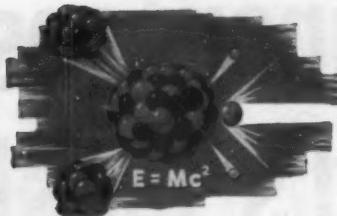
Special wagon drill, built at mine, uses Ingersoll Rand DA 35 rock drill to bore horizontal holes up to 18 ft. deep. EIMCO air motors lubricated with Chevron Vistac Oil power tracks for fast and easy maneuvering.

Why Chevron Vistac Oil cuts costs in air-tool equipment



- Atomizes quickly and completely—carries evenly over all parts. Prevents excessive fogging and has no unpleasant odor.
- Additives help form tenacious, oily, pressure-resistant film in wet or dry conditions—cuts wear and power loss.
- Resists high temperatures and oxidation. Stays fluid at low temperatures.

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Monthly Roundup of Mining News
In the Atomic Energy Field

Homestake Uranium Income Shows Substantial Growth

Homestake Mining Company, traditionally a gold producer, derived 20 percent of its income in the first six months of 1957 from its three Utah uranium operations, according to a prospectus just recently issued. This percentage is slated to substantially increase in 1958 due to developments now underway in the Ambrosia Lake district of McKinley County, New Mexico by Homestake-Sapin Partners and Homestake-New Mexico Partners.

In Utah's Big Indian district near Moab, La Sal Mining & Development Company, a wholly owned Homestake subsidiary, mined 81,435 tons of ore averaging 0.37 percent uranium oxide for the year ended June 30, 1957. Gross revenue (before royalties) per ton mined from this operation during the fiscal year ended June 10, 1957 was \$32.09 per ton mined. The average cost per ton mined was \$7.95. The Little Beaver Mining Company, Inc., another Homestake subsidiary in the Big Indian district, mined 25,256 tons of 0.39 percent uranium ore in the same period covered above. Gross revenue from the Little Beaver operation per ton mined was \$34.05 (before royalties), and the average cost per ton mined was \$11.61 excluding depreciation and depletion. At a third Utah uranium property, the Alice Lease, a 2,895-foot-long inclined shaft, providing a vertical depth of 550 feet, has been completed. Small amounts of ore are now being produced from the North Alice which is expected to attain steady production early in 1958.

In the Ambrosia Lake district of New Mexico near Grants, Homestake is participating in two partnership ventures. At Homestake-Sapin Partners, engineering, design and construction of a 1,500-ton daily uranium mill will be done under a contract now being negotiated with the Utah Construction Company. It is estimated that the mill will be completed by May 1, 1958 at a total cost of approximately \$8,900,000. Ore for this mill will be mined from ore bodies in Sections 15, 23 and 25 McKinley County. On Section 25, a shaft to a proposed depth of 815 feet has been completed. A shaft on Section 23 has been sunk to 36 feet of a proposed 835-foot depth on August 1, 1957. The Section 15 shaft reached a 31-foot depth toward the 595-foot objective on the same date. Profits from the partnership will be split with 25 percent going to Homestake and 75 percent to Sabre Pinon Corporation.

The second Ambrosia Lake project involves Homestake-New Mexico Partners. This group now has a 750-ton mill under construction under contract to Western Knapp Engineering Company. Estimated costs of the facility is \$5,325,000 and it is expected to be completed and in operation by the first of January 1958. Ore for the mill will be mined from Sections 11 and 22 in McKinley County.

Uranium orebodies of the two partnerships in the Ambrosia Lake district of

New Mexico occur in the Westwater Canyon member of the Morrison formation. Depths to the deposits range from 500 to 750 feet. Preliminary pumping tests on a series of exploratory wells, located in the area of the properties to be mined, indicated steady inflowing ground water in substantial amounts. Research has indicated that the ores are economically amenable to a metallurgical treatment

employing carbonate leach followed by caustic precipitation of the yellow uranium salt. Such a process will be employed in the mill at each partnership. Ore reserves at Homestake-Sapin Partners are now estimated at 2,659,350 tons of 0.27 percent uranium oxide. For Homestake-New Mexico Partners, reserves now stand at 1,199,320 tons of 0.25 percent uranium oxide.

Charlie Steen Makes It "Dr." Johnson

Charlie Steen conferred the honorary degree of Doctor of Uranium upon Jesse C. Johnson, director, Division of Raw Materials, United States Atomic Energy Commission, at the formal dedication of the Uranium Reduction Company's Moab, Utah mill on September 14th.

In making the award Charlie said, "Jesse Johnson has been a great friend to the United States and to the world at large through his vast knowledge of uranium and capable use of it. He has been our friend and we feel honored at his having accepted the invitation to be our speaker here today."

The picture shows Jesse looking at the diploma as Charlie reads the citation:



"Greetings to all men from the University of Hard Knocks and Raw Deals by its faculty of prospectors whose sun-blistered brows, bunioned feet, seatless pants, crock hair cuts, and insanely glittering eyes show that they have qualified as bone-fried desert country-type prospectors and uranium hounds. Prospectors who are thoroughly tested by blazing suns, freezing winds, reddish sandstorms, hungry scorpions, and the tall tales of crossroad and county seat bar room liars and promoters. Those who have blistered their rumps riding burros and jeeps, have gone without baths and women, have trekked over deserts, climbed buttes, swum rivers, run rapids and jumped arroyos—not to mention a few claims; who have sat on cactus, killed buckskin out of season, rattled at rattlesnakes, eaten stewed rabbit and porcupine and in desperation tried a bobcat roasted in its own fur jacket; drunk skillet coffee, and smoked other men's cigarette snipes. Men who have located, mined, and milled uranium and who have drilled dry holes on their own without using widows' and orphans' money, and discovered that multi-million dollar lawsuits are actually filed.

"By virtue of the authority of having graduated from all the above experiences with heads bloody but unbowed and still unable to resist the 'click-click' of a probable jackpot on a Geiger counter, we do hereby confer on Jesse "Concentrate" Johnson, the radioactive degree and title of Doctor of Uranium and do declare him entitled to all the rights, privileges, and appurtenances attendant on such a degree because of his having had comparable training and having shown the ability to survive in the jungles of federal bureaucracy under fire and still coming out with uranium concentrates.

**Charles A. Steen, Chief Prospector,
Royal Order of Ragged Prospectors**

William R. Square Deal McCormick, Treasurer of Hardly Able Miners

E. H. Snyder, Pioche-Type Desert Rat "Claim Jumping"

Michell Maybe Melich, Barrister at Claim Jumping. "You jump 'em, I guarantee you title"

Caterpillar announces in the world's most

The engine that delivered outstanding
is now available as the D353 Industrial

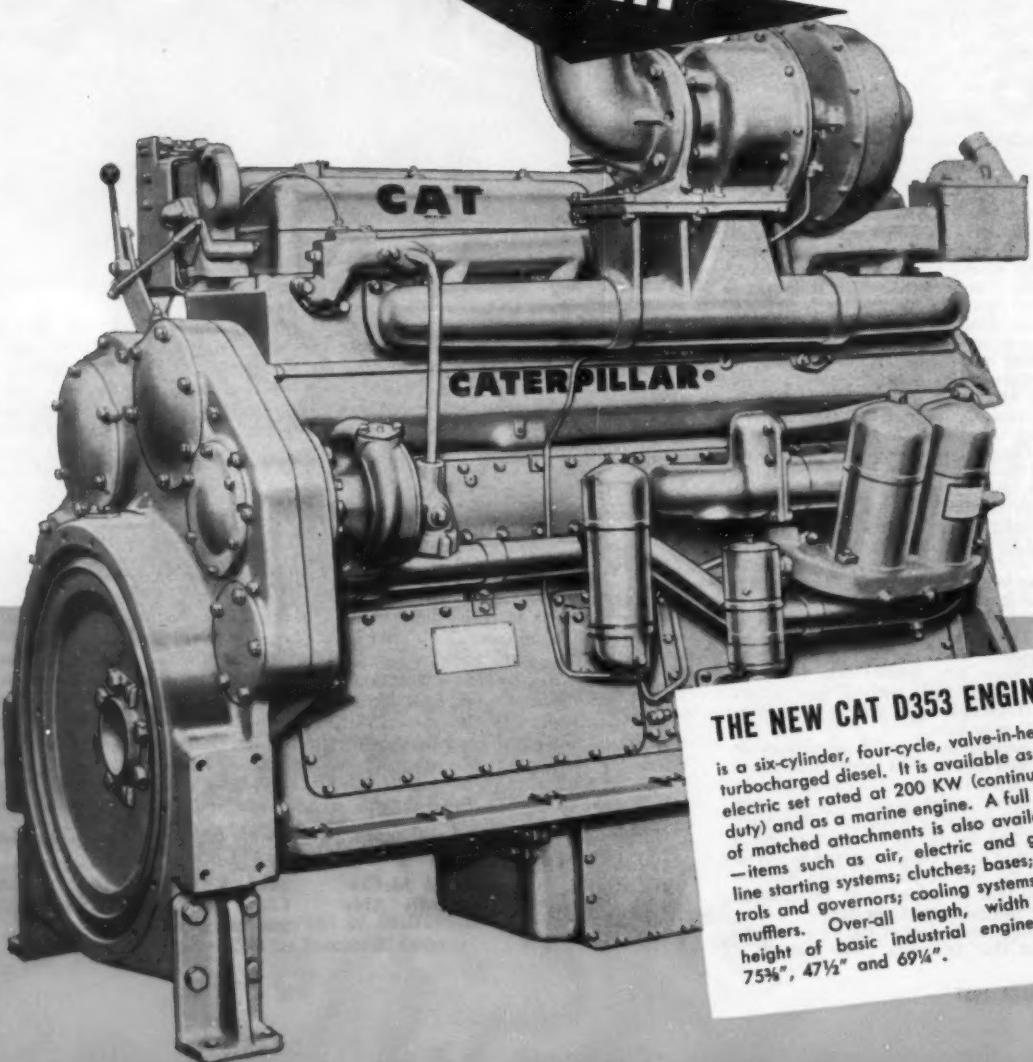
D397
650 HP†

D375
430 HP†

New D353
390 HP†

D342
225 HP†

D339
140 HP†



THE NEW CAT D353 ENGINE

is a six-cylinder, four-cycle, valve-in-head turbocharged diesel. It is available as an electric set rated at 200 KW (continuous duty) and as a marine engine. A full line of matched attachments is also available — items such as air, electric and gasoline line starting systems; clutches; bases; controls and governors; cooling systems and mufflers. Over-all length, width and height of basic industrial engine are: 75", 47½" and 69¼".

another heavy-duty engine advanced line of diesels

performance in the famous D9 Tractor Engine, Electric Set and Marine Engine

D337	D326	D318 (SERIES G)	D315 (SERIES G)	D318	D315	D311
310 HP†	200 HP†	175 HP†	115 HP†	137 HP†	91 HP†	65 HP†

†Maximum output capacity

Adding to Caterpillar's line of modern heavy-duty engines, there's now the Turbocharged D353 rated at 390 HP (maximum output capacity). This engine, a prototype of the unit in the mighty D9 Tractor, is job-proven after thousands of hours of operation in the field!

Like all modern CAT* Diesels, the D353 incorporates in its design the advanced features developed by Caterpillar in a quarter century of diesel leadership. Compact and sturdy, it is built for the hard work. Its four-cycle design delivers the long, effective power stroke that puts power to more efficient use than other types of engines. Its turbocharger utilizes waste energy from the engine exhaust to increase over-all efficiency and economy. Its fuel system requires no adjustment. There are no cylinder ports to clean. And its exclusive Caterpillar single-orifice injection valves, combined with the pre-combustion chambers, permit the use of a wide range of fuels including premium diesel fuels as well as low-cost No. 2 furnace oil *without fouling*. All these and other features add up to performance that no unit in its power class can match.

With the addition of the D353 to the Caterpillar Engine line, you now have a wider choice than ever for your

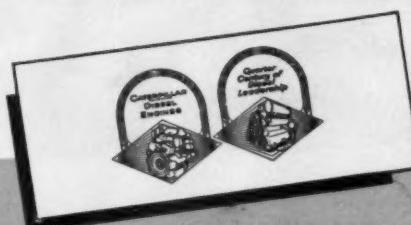
requirements. Engines are available up to 650 HP (maximum output capacity) and electric sets up to 350 KW (continuous duty). Either as original or replacement power, there's one among hundreds of different arrangements that exactly meets your needs. Leading manufacturers of machinery can supply these models in the equipment they build.

For complete information about the new D353 and other Cat Diesels, see your Caterpillar Dealer. Let him show you how diesel leadership based on a quarter century of experience can engineer the modern, heavy-duty diesels of tomorrow.

Caterpillar Tractor Co., San Francisco, Calif.; Peoria, Ill., U.S.A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.



Certified Power for Cat Diesel Engines

Through the years, Caterpillar Engines have earned a reputation for honestly rated power. Now Caterpillar backs this reputation with a notarized certificate covering the horsepower capabilities of each engine. Caterpillar is the first and only manufacturer to give you this assurance of capacity. You have a right to demand certified power when you invest in an engine. You get it when you buy from your Caterpillar Dealer!

Caterpillar "Pride" In a Quarter Century of Diesel Leadership

- "Hi-Electro" hardened cylinder liners
- Chemically conditioned cylinder liners
- Stainless-steel piston protectors
- Aluminum alloy bearings
- Interchangeable, adjustment-free fuel injection equipment

- Capsule-type injection valves
- Service meters
- Superior lubricants (detergent oils)
- Notarized, certified power

AND
MANY MORE!

Announcing NEW TD-6 Under



ALREADY PROVEN IN WORKING MINES, the rugged TD-9 is breaking production records in limestone, iron ore, uranium, salt, and tunnel work. Height is a low, "trolley-clearing" 6 feet! Tractor uses dependable, 24-volt, direct electric starting and lighting system. Rear-mounted, 40-gallon-capacity reserve water tank is sufficient for a full shift.

EASILY-REACHED, STAINLESS STEEL SCRUBBER requires minimum maintenance and only periodic pressure hose cleaning. Scrubber and engine blower fan render exhaust gas harmless to personnel, minimizes fire hazard when used with adequate mine ventilation.

Underground Mining Equipment

APPROVAL No. 2410

The components for this new International Drott underground mining tractor were safety-tested and approved at the Bureau of Mines Laboratory, Pittsburgh, Pa.



ground Mining Skid-Shovel!

Joins proven TD-9 to give you two International Drott feature-packed mining tractors!

Now, you get exclusive wide work range, low equipment investment, and all other exclusive advantages for underground mining in two International Drott underground mining Skid-Shovels...the new 55-hp, 1 cu yd TD-6, and the already proven 71-hp, 1½ cu yd TD-9!

The new, big-capacity TD-6, like the TD-9, meets rigid U. S. Bureau of Mines safety standards (Schedule 24) for underground, non-coal mining. Both machines now feature the new, short-coupled, stainless steel exhaust scrubber—that cools exhaust to a maximum of 160° F., while efficiently dissolving irritating aldehydes with water-bath turbulence. The new design also provides blower fan action on the final exhaust which breaks up noxious gas concentration at a ratio of 40

parts fresh air to one part exhaust.

In addition, low, 5-foot profile and "lean-over" features of the new, compact TD-6 provide unmatched full-load maneuverability, even in the most cramped quarters. You get all the famous, above-ground exclusives, too, like triple-power, pry-action break-out, shock-swallowing Hydro-Spring, and optional Four-In-One providing 'dozer, clamshell, carry-type scraper and regular Skid-Shovel actions.

Prove to yourself the great versatility, productivity, operating ease, and approved safety of the new underground International Drott TD-6 Mining Skid-Shovel. See your International Drott Distributor for a demonstration of the new TD-6 and TD-9!

NOW—get these versatile INTERNATIONAL DROTT attachments for both tractors!



Exclusive Four-In-One is a dozer, bucket, clamshell, and scraper, all in one.



95-inch bulldozer blade mounts directly onto Skid-Shovel lift arms. Easy to control!



Bull angle dozer blade can be angled to either side and has power tilt from operator's seat.



Rock fork constructed of super-strong alloy steel... withstands abrasion of loading hard, heavy minerals.



Third, extra valve of Skid-Shovel controls rear-mounted, heavy-duty scarifier.



Low profile, 2-prong grapple with top grab arm loads ties or mine props with full control.



LARGE, 28-GALLON CAPACITY RESERVE WATER TANK on left fender of TD-6 provides sufficient capacity for full, eight hours. Low-mounted tank is cushioned with foam rubber, permits operator to lean over comfortably and safely under extremely low headings, provides excellent rear visibility. TD-6 uses 12-volt direct starting system.



**INTERNATIONAL®
CONSTRUCTION
EQUIPMENT**

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

SYMONS® PRIMARY GYRATORY CRUSHERS

Built in 30", 42", 54", 60" and 72" sizes, for capacities up to 3500 or more tons per hour.



NORDBERG MACHINERY

for URANIUM PRODUCTION

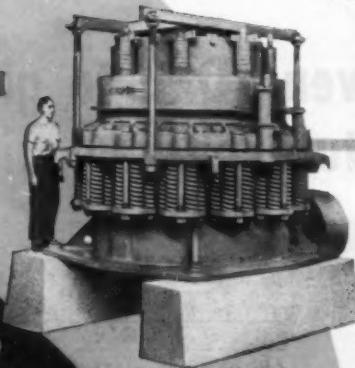
keeps pace with the Atomic Age

URANIUM—the Wonder Metal of the Atomic Age—is today one of the most sought after elements in the earth's crust. And with good reason when you consider that one pound of pure Uranium will produce by fission as much energy as the combustion of 20,000,000 pounds of coal. This powerful new servant serves mankind in many ways and each day its benefits grow increasingly greater.

Increasing too is the role being played by Nordberg Machinery in the efficient processing required for production of this valuable metal. From the Congo and South Africa to the ore bodies of the United States and Canada, leading producers are installing Symons Gyratory Crushers for primary breaking, Symons Cone Crushers for finer reduction, Symons Grizzlies and Screens for scalping and sizing, and Nordberg engines for mine and mill power.

SYMONS CONE CRUSHERS

Built in both Standard and Short Head types, in sizes from 22" to 7", in capacities from 6 to 900 or more tons per hour.



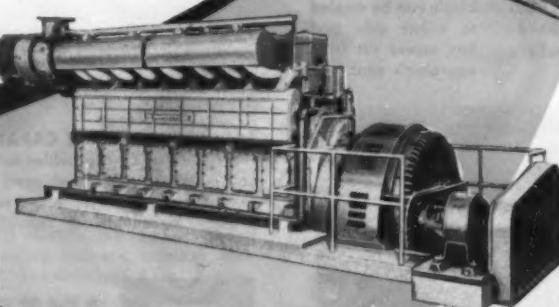
SYMONS VIBRATING BAR GRIZZLIES

Built for heavy duty large capacity scalping service. Particularly effective when handling wet, sticky or gummy ores. Will handle feeds up to 30" and larger.



SYMONS ROD DECK SCREENS

Highly efficient, big capacity units adaptable to mill feed screening and for handling heavy feeds of wet, sticky ores.



NORDBERG ENGINES

Built in a wide range of sizes from 10 to over 12,000 horsepower, including Diesel, Duafuel® and Spark-Ignition Gas types for low cost power generation.

Write for information
on your machinery requirements.

NORDBERG MFG. CO.
Milwaukee, Wisconsin

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Trademark Known Throughout the world.

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NORDBERG

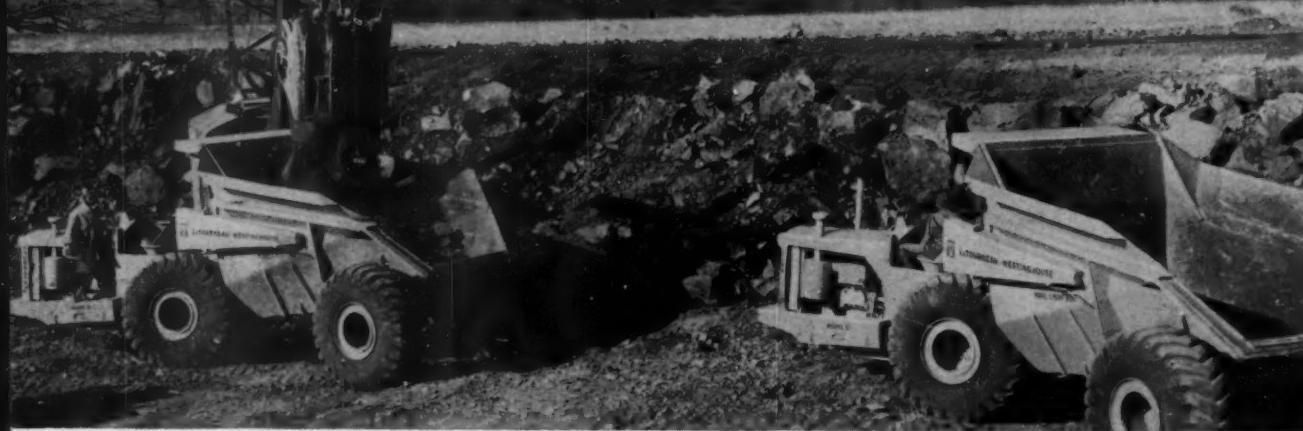
MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • ST. LOUIS • DULUTH • WASHINGTON
TORONTO • MEXICO, D.F. • LONDON • JOHANNESBURG



In restricted areas,

Rear-Dumps outmaneuver, outproduce ordinary haulers



For fast maneuvering in confined loading areas...hauling heavy materials over poorly-graded winding roads, and dumping safely over high embankments...investigate the advantages of heavy-duty Tournapull® Rear-Dumps.

Short turns speed loading cycle

Examine the 22-ton C Rear Dump, for instance, middle size of the LeTourneau-Westinghouse Tournapulls. In confined loading areas, where width of footing is limited, "C's" short 28' turn in haul position (only 20' in dump position) proves very useful. It enables the operator to maneuver safely and easily, position fast under the dipper. Compare this ability to make short-radius turns with that of ordinary dump trucks in the "C's" tonnage hauling class.

Also, the Tournapull's low rear-entry (5'8") lets the shovel operator heap a load fast, at low dumping heights, with minimum spillage.

3,762 sq. in. of brake surface

Multiple-disc air brakes on all 4 wheels give 3,762 sq. in. of braking surface...provide ample safety for downhill haul.

A special safety feature for hilly work areas is the optional *Electrotarder*. It provides auxiliary non-wear, electric-resistance braking through generator on drive-shaft...virtually slows machine to a "walk" without braking.

Dumps fast, safely... keeps firm footing

To dump, operator wheels and spots fast at edge of target area. Setting independently-controlled rear-wheel brakes only, he activates electric hoist motor to raise body into "dump" position. As body raises, wheelbase shortens...swinging bowl below and between rear wheels. This keeps rocks, stones, etc., from piling under hauler or against rear wheels during dump. Front-wheel drive keeps power and traction on solid footing, well ahead of rear wheels.

Rear-Dumps have 4-way built-in protection against bogging down: 1) Power-transfer differential automatically transfers most of the power from slipping wheel to wheel on firm footing. 2) Power-steer through geared kingpin "walks" prime-mover out of ruts—should both drive wheels bog down. 3) "Hump" action, in dumping, brings rear wheels forward as body raises, pushes front wheels forward as bowl is lowered, to inch hauler out of soft footing. 4) Big, low-pressure tires on all wheels float over, do not dig into loose materials, keep traction always.

Interchangeability adds profits

Tournapull Rear-Dump's "bonus" is its interchangeability feature. Rear-Dump body can be easily switched with 18-cu. yd. scraper, 20-ton flat-bed hauler, bottom-dump or crane. Change-

At this pit, two C Tournapull Rear-Dumps are loaded with rock and overburden by a large-capacity shovel. Here the machine's big air-brakes, simple electric controls, positive power-steer, and 90° turning radius, enable it to spot fast under the dipper, maneuver safely and easily over boulder-strewn surfaces.

The operator backs this Tournapull to the edge of the embankment, and dumps material clear over the bank. Clean unloading reduces dozer clean-up. Front-wheel-drive permits a fast, safe departure after dumping.



over, using same 2-wheel prime-mover, takes just a few hours.

You can get bigger production at lower cost with LeTourneau-Westinghouse Rear-Dumps, available in 11, 22, and 35-ton capacities. Let us show you owner-verified reports on these machines working in pits all over the world.

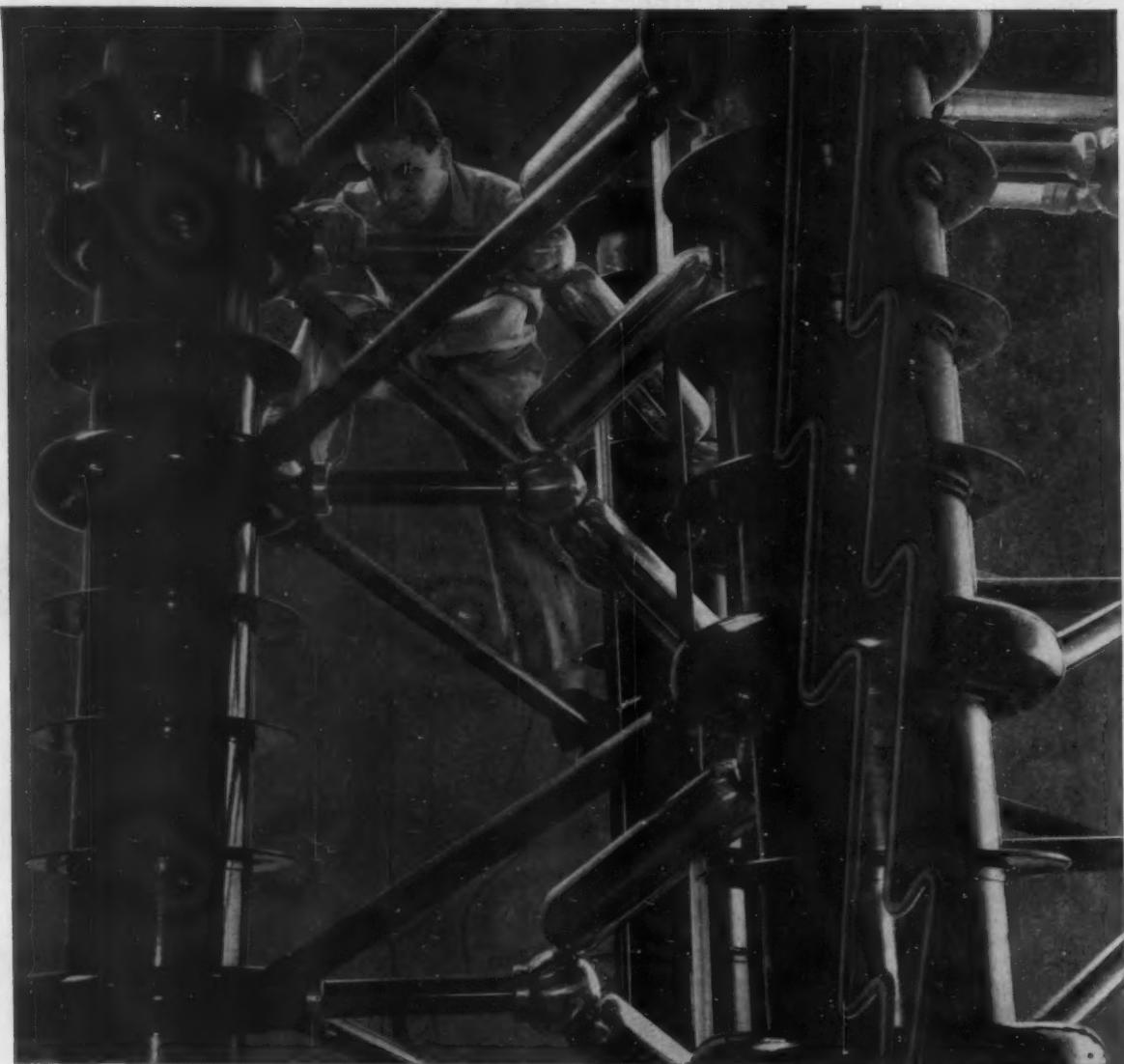
CR-1205-M-1r



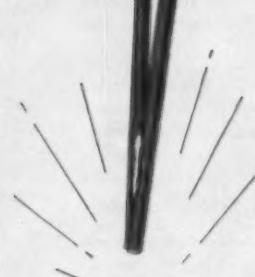
LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



Simplex Wire & Cable Company's new 1,400,000 volt impulse generator — the first of its kind to be installed in North America — represents just one aspect of research at Simplex. Simplex scientists and engineers originated the process of vulcanizing portable rubber cords and cables in a lead mold. Simplex developed the first heavy-duty portable electrical cable — Simplex TIREX. The first truly moisture-resistant rubber insulation was the outcome of a commercially acceptable method of deproteinization developed by Simplex. Simplex designed the first interlocked armored cable for underground service — Simplex CONDEX. And now — Simplex C-L-X — the portable, corrugated metallic duct WITH SEALED-IN CABLE. **SIMPLEX WIRE & CABLE CO.**, Cambridge, Massachusetts and Newington, New Hampshire.



Simplex



Highest quality cables for: Mining • Power & Lighting • Construction • Transportation • Communications • Signalling

Major copper mine in Arizona

helps boost production with 2 heavy-duty graders

Building railroad bed, Adams 660 works dumped waste material to edge of bank for casting overside with bulldozer blade.

Said one grader operator, "The Adams is much faster . . . will do twice as much work. Controls are easier, blade visibility better."

At a large open-pit mine in Arizona, ore is mined at low levels and hauled by railroad cars . . . at higher levels, overburden is removed by a fleet of 35-ton trucks. To help these haulers travel at safe, profitable speeds, and to speed road and railspur construction — the mine uses two 150 hp Adams* 660 graders.

Patrols roads 24 hrs. a day, 6 days per week

One of the heavy-duty "660" LeTourneau-Westinghouse units is used primarily for maintaining many miles of haul roads. This fast-moving grader patrols these busy mine roads 24 hours a day, 6 days a week. It goes wherever needed . . . to fill ruts, level washboard, clear debris dropped by overloaded haulers and improve drainage.

For working along steep drop-offs, the Adams' standard blade extends

a full 7½ ft. beyond wheel line, to give operator safe working margin. Extra-safe dual-braking system stops transmission as well as tandem drive-wheels for sure, safe stops and minimum brake wear.

Helps build new roads

The second "660" grader—equipped with bulldozer blade—is used on new construction work and for maintaining waste dump. When constructing new roads or railroad beds, the "660" handles all the blade work.

Works any kind of material

Wide range of speeds give Adams advantage for working efficiently in any kind of material. All 80 to 150 hp Adams graders have an 8 forward and 4 reverse speed transmission. In addition, optional 3-speed "creeper" gears (0.23 to 1.82 mph) may be added. These low, full-

power speeds move heavier loads, handle rocky material with greater speed and safety, insure more accurate blade control for fine finishing around forms or obstructions.

Adams' largest grader — the powerful 190 hp POWER-Flow 660, with torque converter — gives you an infinite number of speeds forward to 27.4 mph . . . reverse to 24.4 mph. Adams' smallest, the 60 hp "220", has 5 speeds forward to 18.3 mph — best in its class.

Ask for more information

Why not learn how you, too, can increase mine and quarry production, decrease operating costs with Adams graders? There are 6 models: 190, 150, 123, 115, 80, 60 hp. Choose between General Motors and Cummins engines on the 5 larger models. Write us for more information.



With dozer blade, "660" maintains waste dump. Over 72% of the total amount of material mined at this copper mine is waste.

Powerful "660" helps build exploration roads and Railroad beds fast and easily. Commenting on the Adams motor grader, the second operator said, "I like the power and weight of the '660'. Also, the big 14-ft. moldboard and wide choice of speeds."



*Trademark G-1483-M-1r



LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

Delicate appetite for a "Queen"...

80 TONS IN



ONE BITE!

BUT LOOK AT THE SIZE OF HER! Taller than a 13-story building, and weighing 2,400 tons, this lady is entitled to a queen-size appetite. She's the *River Queen* — largest power shovel ever built by the Bucyrus-Erie Company. And her big 80-ton bucket is made of tough USS "T-1" Steel to keep her eating regularly for a long time.

Backed by 11 powerful motors and fronted by a formidable row of ripping teeth, the Queen's huge maw scoops up 55 cu. yds. of overburden at a gulp and dumps it nearly 300 feet away from the digging point. Digging and dumping in less than a minute, the *River Queen* could pile up a mountain of more than 100,000 tons of overburden in 24 hours!

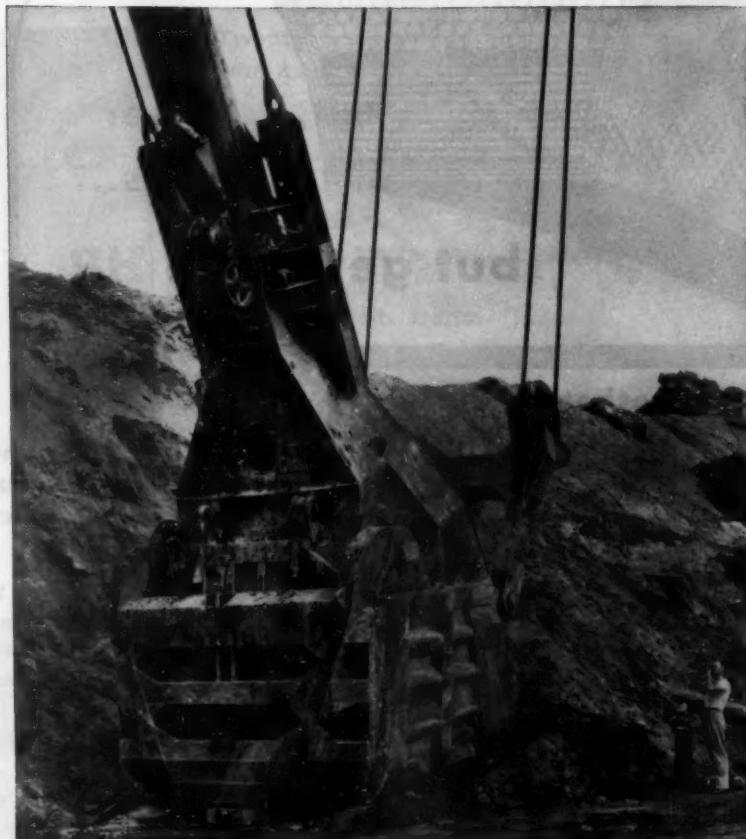
The big shovel is being used to uncover two seams of coal for W. G. Duncan & Peabody Coal Companies in western Kentucky. When the mine is in full operation, its output is expected to be 2 million tons of coal annually. The "Queen" will be highly instrumental in making this possible.

With all the weight and mechanical muscle the big shovel possesses, her bucket has to be a real battering ram. That's why it's made of USS "T-1" constructional alloy steel. Bitting and ramming through rock and earth, hour after hour, day after day, is punishing service. USS "T-1" Steel is designed to take this kind of impact, shock and abrasion. And its amazing toughness never falters, even at temperatures far below zero.

You Need USS "T-1" Steel

When you want strength far beyond the ordinary, USS "T-1" Steel has nearly three times the yield strength of structural carbon steel. This is far higher yield strength than has ever before been available in weldable plate steel. What's more, its strength is not lowered by welding or gas-cutting.

For equipment subject to impact abrasion, USS "T-1" Steel can be obtained quenched and tempered to a minimum hardness of 321 Brinell. Even this very hard grade can be welded and flame-cut right in the field without pre-heating. Thus, you don't have to shut down costly, big-capacity equipment for the many hours generally required for shop repairs.



The very high yield strength of USS "T-1" Steel—90,000 psi—saved tons of weight in the big bucket, making a bigger pay load possible with each scoop. Speaking of strength, the 86-foot dipper handle and 145-foot boom are made of another U. S. Steel product, USS TRI-TEN high strength steel.

If your equipment must withstand severe impact abuse, USS "T-1" Steel insures against damage in winter weather. Whether furnished to 321 minimum Brinell or to 90,000 psi minimum yield strength, it has exceptional toughness and resistance to

brittle failure, even at temperatures far below zero.

• • •
USS "T-1" Steel can save you money. Send for our new catalog for the full story. Write to United States Steel, Room 2801, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

Also available from United States Steel—USS COR-TEN, USS TRI-TEN, and USS MAN-TEN steels—for many years standards for mining and ore handling equipment.

United States Steel Corporation, Pittsburgh • Columbia-Geneva Steel Division, San Francisco

Tennessee Coal & Iron Division, Fairfield, Ala.

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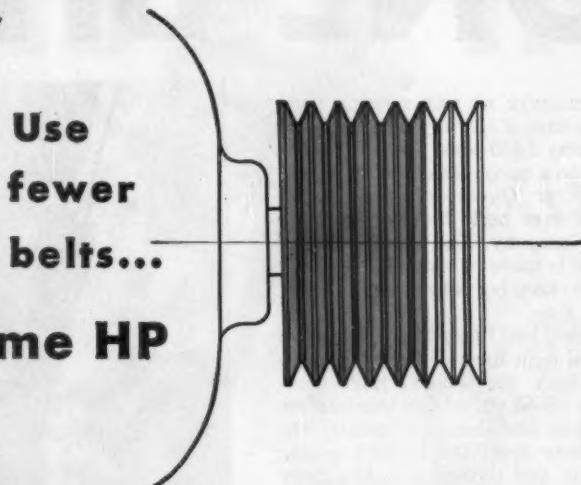
USS "T-1" CONSTRUCTIONAL ALLOY STEEL

"USS," "T-1," Cor-Ten, Man-Ten and Tri-Ten are registered trademarks

UNITED STATES STEEL



5 Gates Super Vulco Ropes do the work of 7 standard V-belts



No other V-Belt has ALL these advantages

1. Flex-Weave Cover (U.S. Pat. 2519590)



A Gates exclusive: provides greater flexibility with far less stress on fabric. Cover wears longer . . . increases belt life . . . more power available to driven machine.

2. Concave Sidewalls (U.S. Pat. 1813698)



Concave sides (Fig. 1) increase belt life. As belt bends, concave sidewalls become straight, making uniform contact with sheave groove (Fig. 1-A). Uniform contact means less wear on sides of belt . . . far longer belt life.



3. Tough, resilient Tensile Cords



Super strong resilient tensile cords provide 40% greater horsepower capacity . . . easily absorb heavy shock loads . . . reduce number of belts required . . . save weight and space.

4. High Electrical Conductivity

Built into Gates Super Vulco Ropes for safer drives (in explosive atmospheres).

5. Oil, Heat, Weather Resistant

Special rubber compounds make Super Vulco Ropes highly resistant to heat, oil, and prolonged exposure to weather.

**Cut sheave width and weight
... design your drive to benefit from
the greater HP capacity of Gates Super
Vulco Ropes.**

5 Gates Super Vulco Ropes will do the work of 7 Standard V-Belts. A Super Vulco Rope Drive delivers more HP per dollar invested than any standard V-Belt drive.

Sheaves with fewer grooves cost less . . . weigh less . . . occupy less space. Your drive design is improved.

Helpful drive data is quickly available to you. Simply call your nearby Gates distributor for advice from a Gates V-Belt Specialist. Stocks carried in industrial centers throughout the world.

The Gates Rubber Company

Denver, Colorado



TPA 264



The Mark of Specialized Research

Gates Super V^{ULCO}_{ROPE} Drives

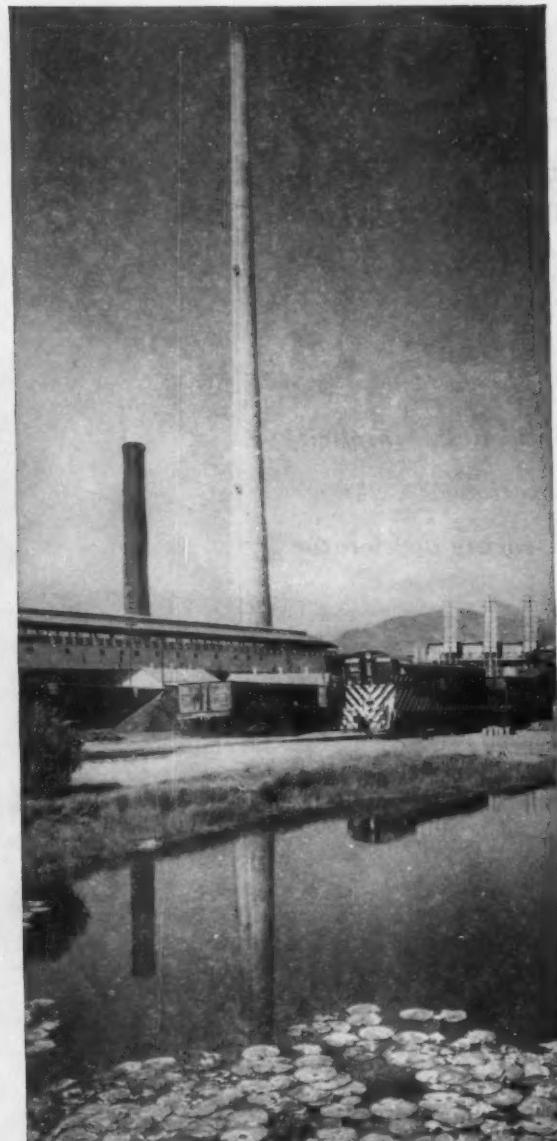
Look first to:

AMERICAN SMELTING AND REFINING COMPANY

LONG EXPERIENCE IN BUYING, SMELTING AND REFINING ALL TYPES OF ORES, INCLUDING:

GOLD, SILVER, LEAD, COPPER AND ZINC

ORES AND CONCENTRATES, BLISTER COPPER, MATTES AND RESIDUES



Twenty-two smelters and refineries,
with advantageous F.O.B.-plant terms:

LEAD SMELTERS

Selby, California
Leadville, Colorado
Alton, Illinois
East Helena, Montana
El Paso, Texas
Chihuahua, Chih., Mexico
San Luis Potosi, S.L.P., Mexico

ZINC SMELTERS

Amarillo, Texas
Corpus Christi, Texas
Rosita, Coah., Mexico

COPPER SMELTERS

Hayden, Arizona
El Paso, Texas
Garfield, Utah
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Now . . . major advances make the Allis-Chalmers HD-21 more productive than ever . . . capable of handling big-tractor jobs of every kind with the efficiency and dependability all open pit operators want and need.

New 225-net-hp turbo-engine

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New heavy-duty matched dozers

Here's a big tractor you can depend on to help you on a wide range of stripping and maintenance jobs. Your Allis-Chalmers dealer will be glad to talk to you about the new "21" . . . and to prove its value in a working demonstration on your job. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.



ALLIS-CHALMERS

Engineering in Action

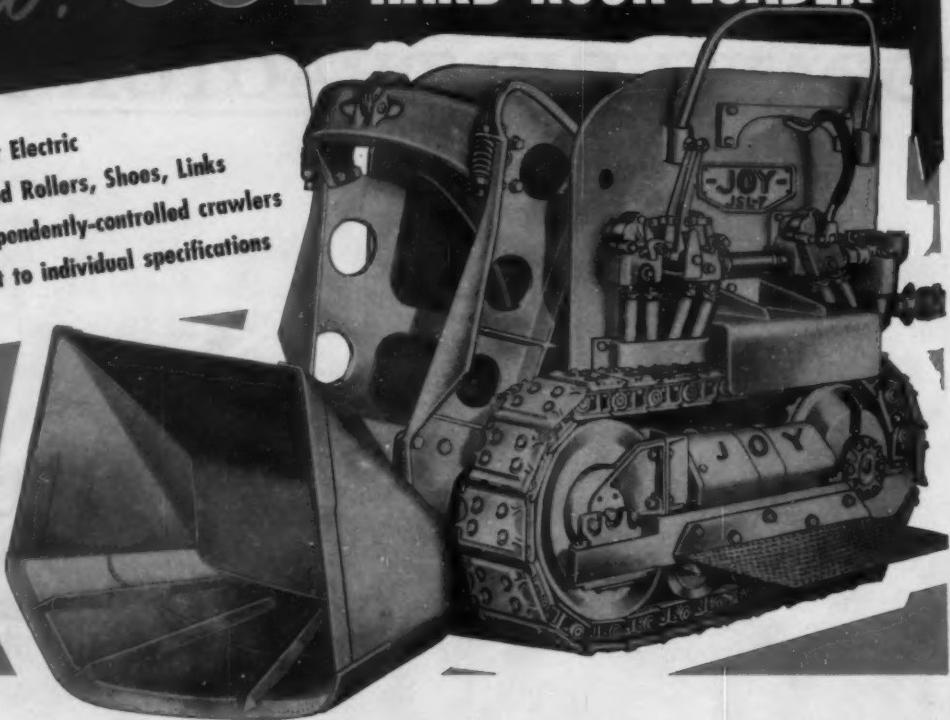
TODAY'S BIG-TRACTOR JOBS!



NEW HD-21 IN ACTION with new 15-ft angle-dozer;
approximate total weight, 56,225 lb.

New! JOY HARD ROCK LOADER

- Air or Electric
 - Forged Rollers, Shoes, Links
 - Independently-controlled crawlers
 - Built to individual specifications



Joy JSL-7 Loader	Specs
Height, minimum	60"
Headroom Range	79" to 114"
Width, overall	57½"
w/platform	68"
Length, bucket in digging position	112½"
Weight, Air	9,650 lbs.
Electric	11,250 lbs.
Loading, average	2—4 tpm



**WRITE
FOR
FREE
BULLETIN
203-8**

Write for this new bulletin covering
the Joy JS-7 Shovel Loader. 8 Pages
of dimensions, weights and drawings.

The all-new Joy JSL-7 Shovel Loader is designed and built specifically for the really rough hard rock jobs. This crawler-mounted brute has been beefed up with forged parts at all the tough impact points; has three interchangeable Pistonair® motors in the air version—(255 ft. lb. stall torque motors in the electric)—and delivers a 12,080 lb. crowding effort at the bucket lip.

Independent Crawler Control

Each crawler, independently powered by a famous Joy 15 hp Pistonair motor, is reversible . . . the Joy JSL-7 can turn in its own length. No need for run-backs and repositioning when this Shovel Loader swings into action!

Control Positioning Optional

Standard positioning of controls on left side of Loader as pictured. Right-side mounted or dual mounted controls are also available in either air or electric models. "Deadman" controls flip to neutral when released.

Joy Builds to your Requirements

In addition to standard specifications tabulated at left, the Joy JS-7 Shovel Loader is available with special buckets, arms and counter weights for mucking on grades greater than 9° uphill or 15° downhill. Arrangements for bucket discharge heights to 87" are available.

Call in the Joy Engineer and tell him what you want the JSL-7 to do for you. Ask him about the choices of bucket design and capacity, grousers, 'dozer attachments and other available extra equipment. Write to *Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.* In Canada *Joy Manufacturing Company (Limited), Galt, Ontario.*

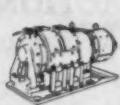
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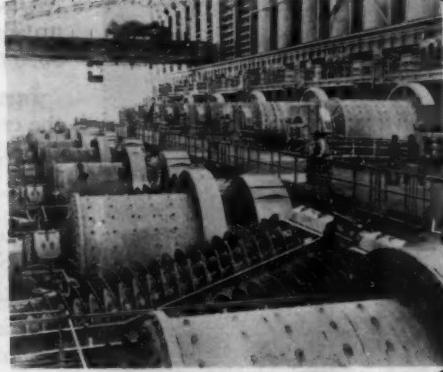


Drillmobiles

MINING WORLD

I saw them in Chile, too!

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Twelve 10' x 10' Marcy Ball Mills, six 6' x 12' Marcy Ball Mills and twelve 10' x 14' Marcy Rod Mills at Chile Exploration Company, Chuquicamata, Chile. In addition to these 30 mills there are approximately 50 additional Marcy Mills in Chile.



One reason...

Marcy principle of grinding increases tonnage up to 33%

"Rapid change of mill content is necessary for high efficiency" . . . that's the Marcy principle of grinding. It is accomplished by use of **full-grate** discharge on Marcy Ball Mills and the **open-end** feature on Marcy Rod Mills.

In seven representative installations where overflow mills were converted to Marcy Grates the average increase in tonnage was 33.6% with an average decrease in power of 0.95 KWH per ton.

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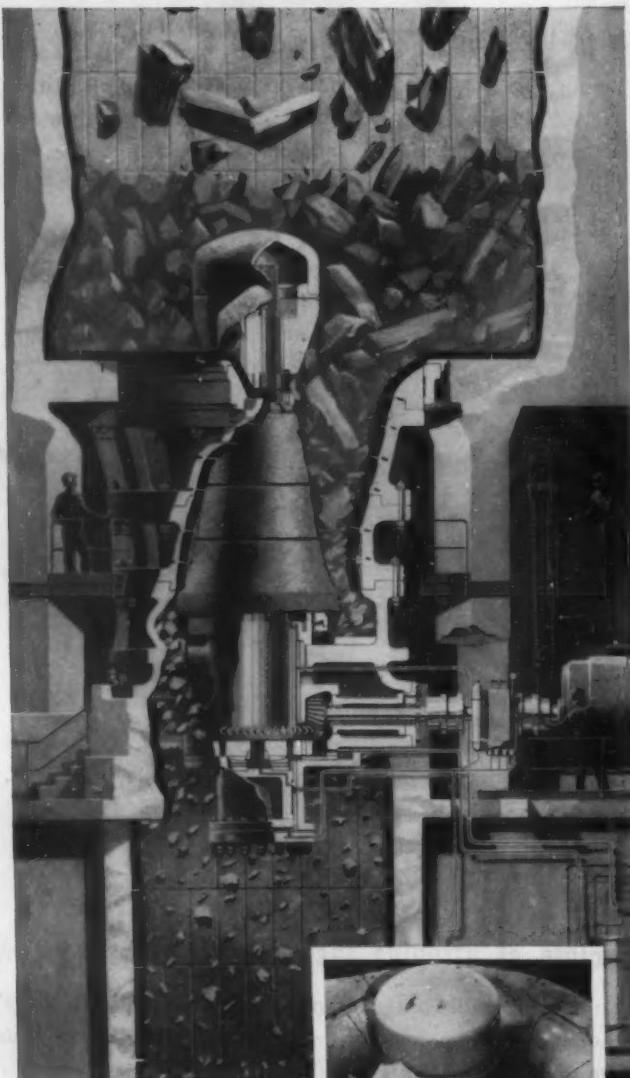


Illustration above by courtesy of
Socony Mobil Oil Co., Inc.



Amsco® Manganese Steel
takes terrific punishment
in world's largest crusher

Iron-bearing taconite rock is so hard it can't be drilled by ordinary methods. Yet chunks up to 5 feet in size can be fed into this giant crusher and chewed up into 10-inch pieces—at the rate of 3500 tons per hour.

Imagine the terrific punishment given the crusher mantle and concaves by the churning impact and abrasion of super-hard taconite rock. That's why these vital crusher parts are cast of "the toughest steel known"—Amsco Manganese Steel. It's the *only* material tough enough to take such a beating!

This 625-ton giant, built by Allis-Chalmers, is the world's largest crusher. It's helping provide America's steel industry with a dependable new source of iron ore—both now and for years to come.

Here's one more example of the ability of Amsco Manganese Steel to stand up under the toughest impact and abrasion conditions. Consult your equipment manufacturer, or write us direct, for technical information on the long-wearing properties of Amsco Manganese Steel—for crushing, digging or hauling applications.

Mantle and concaves (shaded portions) in this rock-crushing giant are cast of Amsco Manganese Steel. Mantle weighs approximately 40,000 lbs.—the concaves, or side plates, approximately 71,000 lbs.



AMSCO

American Manganese Steel Division • Chicago Heights, Ill.

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REAR-DUMPS

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Downtime and maintenance costs are held to a minimum as a result of the easy service accessibility of all major components. Interchangeability of the semi-trailer rear dump bodies with 7 and 18 yard scraper bowls provides extra flexibility for changing job requirements.

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REAR-DUMP

12 tons payload . . .
11 cu. yds. heaped . . .
143 h.p. . . .
18.00x25 tires . . . top speed
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NoSpin differential.



AND THE **S-18**

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300 h.p. . . . 27.00 x 33 tires
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Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE





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BC-10

ALLIS-CHALMERS

Engineering in Action

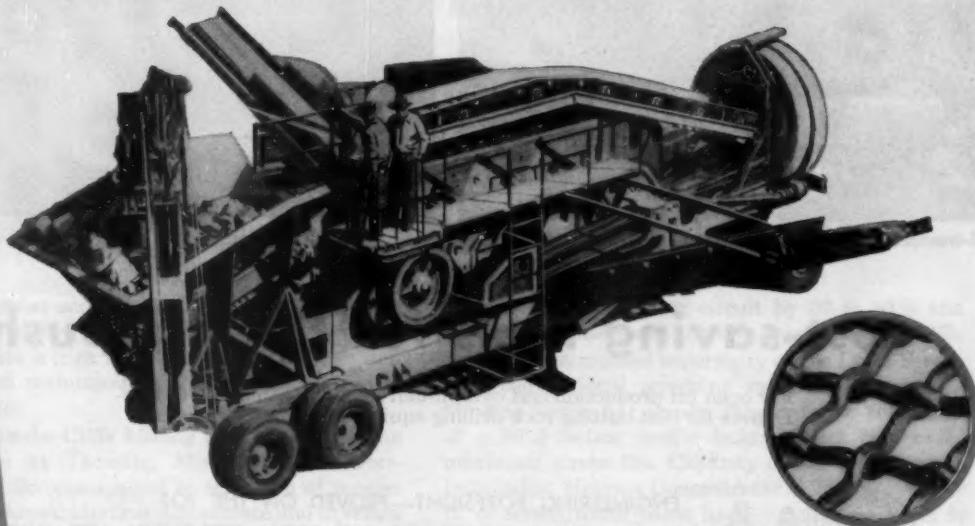


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New 5½" heavy-duty rock drill on self-propelled crawler.



All-weather rotaries in 600-foot and 900-foot capacities.



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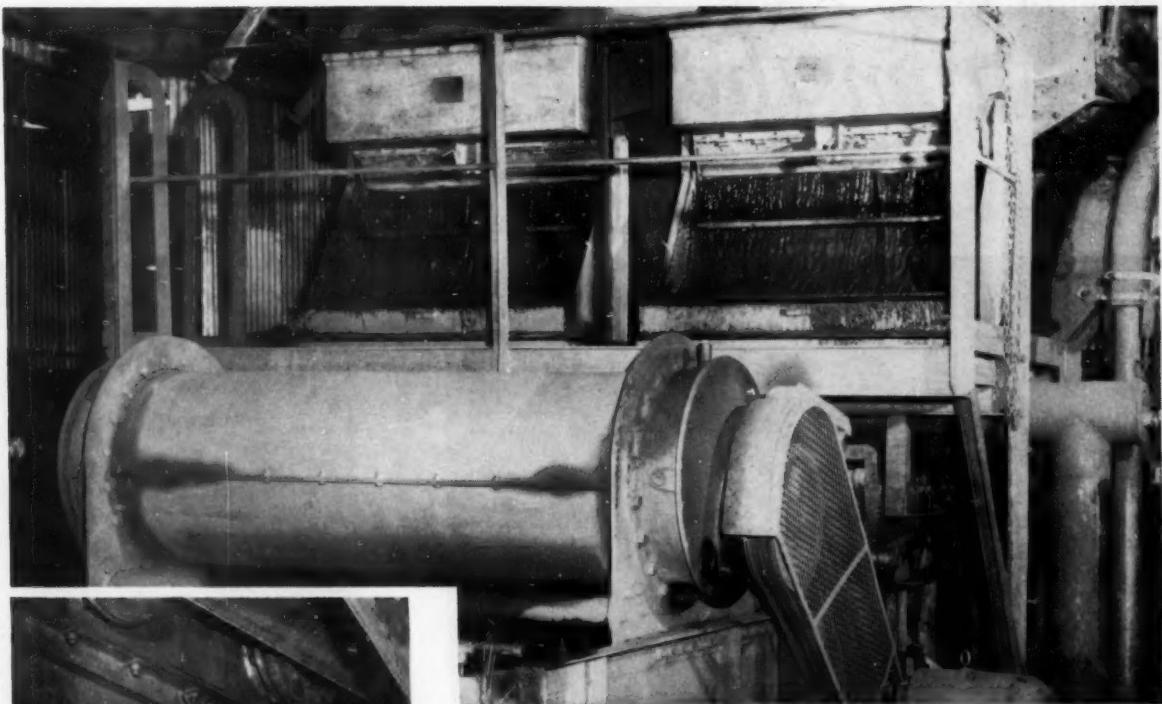
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Rear view of unit, note total utilization of entire screen area.

*magnetite medium losses reduced
in heavy media cyclone plant on
Mesabi Range with*

DORR-OLIVER DSM SCREEN

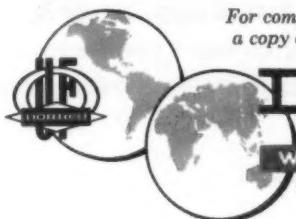
One of the most serious operating problems in the beneficiation of low grade iron ore in heavy media cyclone plants is high magnetite medium losses and difficulties in maintaining a clean medium free of non-magnetics.

At the Mesaba-Cliffs Mining Company's Holman Concentrator at Taconite, Minnesota, the Dorr-Oliver DSM Screens applied to screening of magnetite from cyclone underflow concentrate and overflow tails have consistently reduced the amount of medi-

um sent to the cleaning circuit by 30 to 50% and reduced medium losses thereby approximately 20%.

Key to the marked superiority of the DSM Screen over conventional screening methods is the non-blinding wedge bar screen, fabricated to tolerances of $\pm .0015$ inches; profile design is such to provide maximum screen life. Capacity of the 4' wide units installed at Holman Concentrator is 75-100 gpm per ft. of screen width when handling minus 8 mesh to 0 material at 70% solids.

For complete information on this newest tool for the mining industries, write for a copy of Bulletin No. 2300. Dorr-Oliver Incorporated, Stamford, Connecticut.



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Whether you are developing the flow scheme for a new ore body or seeking ways to improve your present reagent combination, Cyanamid Field Engineers can give you very practical help.

They can bring you access to a vast reservoir of data on processes and reagent combinations proved most effective in mills all over the world. This operating data is supplemented by the work of Cyanamid Mineral Dressing Laboratory where basic research on better reagents and application methods goes forward unceasingly.

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Yes, it will pay you well to avail yourself of DECO's complete ORE TESTING services*...in time, money AND ore beneficiation!

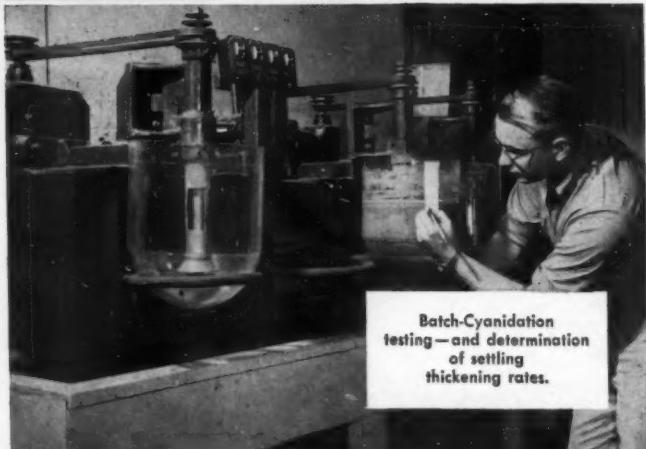
*DECO's Ore Testing Division is operated as a non-profit service for the benefit of our customers.



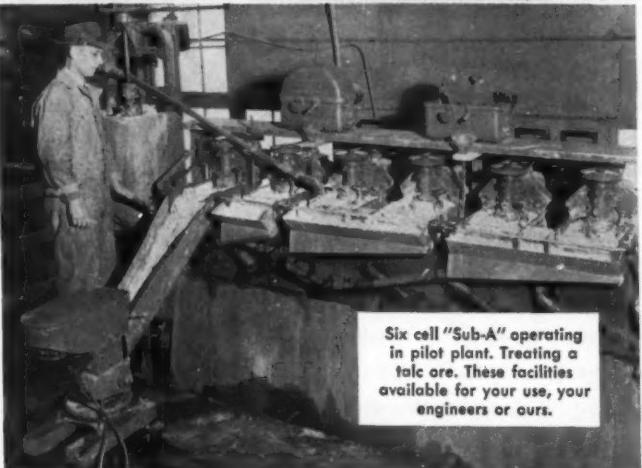
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Batch Testing — running a flotation test. 385 samples tested last year.



Batch-Cyanidation testing — and determination of settling thickening rates.



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Mining World

THE IMPORTANT MINING MAGAZINE EVERYWHERE

November 1957

INTERNATIONAL PANORAMA

MOA BAY, CUBA—Freeport Sulphur Company's subsidiary, Moa Bay Mining Company, has awarded a contract for approximately \$75,000,000 to the Frederick Snare Overseas Corporation for plant and auxiliary facilities for mining and concentrating nickel-cobalt ores. Concentrates will be shipped to the United States for refining.

MANILA, REPUBLIC OF THE PHILIPPINES—Newmont Mining Corporation and Atlas Consolidated Mining and Development Corporation have signed a contract for Newmont to find and block out additional ore reserves by geophysical methods at and near the Atlas copper mine at Toledo, Cebu.

GRANTS, NEW MEXICO—The Phillips Petroleum Company has received a concentrate purchase contract from the United States Atomic Energy Commission under which it will build a 1,750 ton-per-day uranium mill at Ambrosia Lake.

HIGHLAND VALLEY, BRITISH COLUMBIA—Kennebott Copper Corporation has increased its copper holdings here by optioning the claims of Kain Copper, Ltd. The option and exploration contract by Kennebott's subsidiary, Northwestern Exploration, Ltd., extends to March 1, 1964.

ATLANTIC CITY, WYOMING—United States Steel Corporation's Columbia-Geneva taconite mine and beneficiation plant here came a step nearer to operation as a group of contractors toured the mine area preparatory to submitting their construction bids.

HENDERSON, NEVADA—A new company, AFN, Inc., has been formed to produce high energy boron fuels for the Air Force. American Potash and Chemical Corporation will supply boron from its Seales Lake, California deposit. Food Machinery and Chemical Corporation and National Distillers and Chemical Corporation are American Potash's partners in the new company.

GRANTS, NEW MEXICO—Phillips Petroleum Company has developed between 4,000,000 and 5,000,000 tons of uranium ore on its Ambrosia Lake properties.

CHUNYA, TANGANYIKA—Newmont Mining Corporation and associates have formed Western Rift Exploration Company Ltd. to explore and prospect a 34,000-square-mile concession 300 miles long in western Tanganyika. Associated firms include Anglo American Corporation of South Africa, British South Africa Company, and Tanganyika Concessions Ltd. Preparations are being made for an extensive major exploration program.

TEMANGAN, MALAYA—Oriental Mining Company has reopened the Temangan iron mine with shipments scheduled to Japan. The mine operated before World War II. New equipment and three miles of railroad were necessary to reopen the mine.

CANBERRA, AUSTRALIA—The Commonwealth government has raised the bonus payable to certain gold producers. Maximum payment to large mines has been increased from £A 2 to £A 2 15s per ounce. Allowance for development expense has also been raised.

TACONITE HARBOR, MINNESOTA—The first shipload of taconite pellets from the new harbor of the Erie Mining Company has been made to Bethlehem Steel Company. When the new Erie plant where initial units are operating reaches capacity, 7,500,000 annual tons of pellets will be produced.

NORANDA, QUEBEC—A new reverberatory furnace just placed in operation will permit Noranda Mines Ltd. to raise copper output to 130,000 annual tons.

WELKOM, ORANGE FREE STATE—The Free State Saaiplaas Gold Mining Company, Ltd. set a new world's shaft sinking record at its No. 2 shaft in September. The round, 27.5 foot diameter ventilation shaft was sunk 834 feet and concrete lined for 810 feet during the month.

LONDON, ENGLAND—Russia is offering to sell pig lead here for the first time in many years. Zinc, tin, tungsten, and antimony have been exported from Russia for some time.

Public Hearing On Lead-Zinc Tariff Investigation

The United States Tariff Commission has requested that interested parties desiring to appear and give testimony on lead-zinc notify the Commission secretary in writing at its office in Washington, D. C. five days before the hearing which starts on November 19th.

This public hearing which will be held beginning at 10:00 AM Eastern standard time in the Hearing Room of the United States Tariff Commission, 8th and E. Streets, N. W., Washington, D. C. was ordered by the Commission on October 4th. The request for the hearing was made by the Emergency-Lead-Zinc Committee on September 27th. The hearing is to determine whether lead and zinc are "being imported into the United States in such increased quantities, either actual or relative, as to cause or threaten serious injury to the domestic industry or industries producing like or directly competitive products."

AEC Contract Awarded To Phillips Petroleum

Construction of a 1,725-ton-daily-capacity uranium processing mill is underway by Phillips Petroleum Company of Bartlesville, Oklahoma following a contract made recently with the United States Atomic Energy Commission for the sale of uranium concentrates. The mill will be located in McKinley County, New Mexico, about 25 miles north of Grants and is being built by Western Knapp Engineering Company.

The \$9,500,000 mill is scheduled for completion by the middle of 1958. Ores treated in the plant will include ores from properties owned or controlled by Phillips and ore purchased from independent mine operators in the area.

Phillips began exploration in the Ambrosia Lake area in 1955 and by early 1956 had blocked out sufficient ore to warrant construction of a mill. Drilling has already indicated between 4,000,000 and 5,000,000 tons of uranium ore in several closely associated ore bodies, and exploration is continuing.

This is the fourth contract made in recent months involving construction of a mill to treat Ambrosia Lake ores. The other three are Homestake-New Mexico Partners plant, which will handle 750 tons a day when construction is completed; the Homestake-Sapin Partners mill, which will handle 1,500 tons a day; and the Kermac Nuclear Fuels Corporation mill, which will handle 3,300 tons daily.

The Phillips mill will be the sixth uranium processing plant to be located in New Mexico to treat ores produced in the state.

Next Month — Western Nuclear: From Penny Stock To Integrated Producer



MUCK HOISTING SHAFT of the Mineral Hill mine is a two compartment, 54° incline. The hydraulic backfill batching plant serving the Mineral Hill and Daisy mines is shown.



VERTICAL two compartment service shaft of the Mineral Hill mine is visible in the background. Mill tailing thickeners are in foreground. The shaft bottoms below the 500 level.

Geology and Exploration Point Way

Banner Mining Company, which has followed a pattern of small mine development, doubled underground productive capacity of its operations south of Tucson, Arizona in the past three years. Though the recent sharp drop in metal prices has forced a temporary reduction of output, the firm has compiled a remarkable record. Latest mine to be readied for production was the Copper Glance in the Twin Buttes district, 7 miles south of Banner's Mineral Hill and Daisy mines in the Pima district. Prior to the reduction of output, the Copper Glance was slated to add 200 tons of copper ore per day to the 600-ton combined output from the Mineral Hill and Daisy workings.

Both the Pima and Twin Buttes districts have been the scene of intense exploration and development activity in recent years. Pima Mining Company has developed a 4,000 ton per day open pit adjacent to Mineral Hill area. Further south in the Twin Buttes district Duval Sulphur & Potash Company is making plans for a 10,000 ton per day open pit and mill. To the north American Smelting & Refining Company has done considerable drilling and reports indicate a sizeable deposit has been probed. But Banner led the entire group into production when its 400-ton daily mill

started in May of 1954. In the intervening period milling capacity has been increased to 1,000 tons per day.

Banner's three mines in this area represent outstanding examples of successful growth and development which was aided in part through the Defense Minerals Exploration Administration program. The company for many years centered operations near Lordsburg, New Mexico where copper ore was extracted from several small underground mines with a combined output of 300 to 400 tons daily. Banner first became interested in the Pima and Twin Buttes districts when general manager A. B. Bowman was making a general field reconnaissance of the area in 1950. Two contracts totaling \$262,000 were signed with the DMEA. One contract covered reopening and exploration of the Mineral Hill property and the second involved similar work at mines in the Twin Buttes district.

As an outgrowth of this campaign the Mineral Hill mine was rehabilitated and a 400 ton-per-day concentrator was put into operation. In exploring a thrust fault zone to the east of the Mineral Hill, additional ore was found and the Daisy mine subsequently was developed in 1954. Development of the Copper Glance followed soon after and four stopes were ready for production this spring.

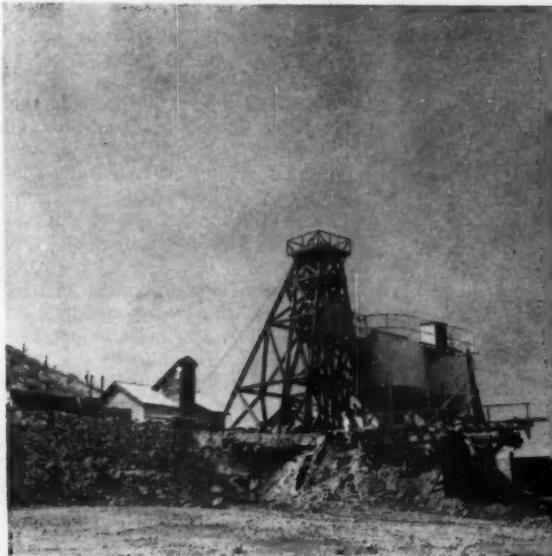
Past Production

The Copper Glance mine together with the Senator Morgan Copper Queen, Minnie and other mines in the Twin Buttes district had been worked from early 1900 through World War I, yielding over 400,000 tons of high-grade copper ore conservatively valued at \$10,000,000. Some idea of the grade can be obtained from the fact that the above valuation was calculated when copper was priced at \$0.09 to \$0.13 per pound. The situation at Mineral Hill in the Pima district was one of intermittent production from shallow underground workings at or near outcrops. During World War I, development to a depth of nearly 700 feet was undertaken at Mineral Hill, but production ceased in the early 1920's.

Geology

The known ore deposits of both the Pima and Twin Buttes districts occur at or near the contacts of intrusive granites with limestones and quartzites. The deposits are typical of pyrometasomatic mineralization with contact zoning of high temperature gneiss minerals.

Structural control of the ore bodies in the Pima district seems very appar-



DAISY MINE was developed 3,500 feet east of the Mineral Hill mine. This view shows the headframe and two, 120-ton capacity ore bins at the Daisy shaft.



COPPER GLANCE surface plant is shown in the above picture. This mine is located in the Twin Buttes district, about 7 miles south of the Mineral Hill and Daisy mines.

For Banner's Copper Developments

ent. Banner's property is crossed from east to west by a pre-ore thrust fault which dips 50° to the south. The known deposits are found along this main structure in close proximity to a granite stock or at intersections of the thrust fault with cross-faults located near intrusive contacts. At the Mineral Hill mine granite forms the footwall of the thrust shear below the 300 level. A major north-south, post ore fault separates the Mineral Hill and Daisy mines. The Daisy is thought to lie along the same ore branch of the east-west thrust zone. The sedimentary rocks generally strike northwest; crushing and folding is intense. The sedimentary rocks have been metamorphosed with the formation of alteration products, such as lime silicates, marble, garnetite, chlorites, epidote, and kaolin. A metamorphosed, impure limestone, locally called clay-garnet, is a favored host rock.

Individual ore bodies are irregular in size, shape, and distribution. The dip is relatively flat with an overall average of 30 to 45° to the south prevailing. An ore shoot, however, pinches and swells along the dip; in some instances this irregularity of the footwall and hanging wall is so pronounced that in cross-section normal to the strike a deposit may assume the appearance of a tabular shape bounded by walls which slope 35°

to the south. Horizontal widths vary from 30 to 150 feet.

Mineral Association

Principal copper mineralization is chalcopyrite with minor amounts of bornite and chalcocite. Molybdenite and scheelite are accessory minerals, but do not occur in quantities sufficient to warrant recovery. Locally, magnetite and pyrrhotite are present in varying quantities in close association with the ore minerals. The association of magnetite with copper mineralization has served as an important exploration aid in both the Pima and Twin Buttes districts. Magnetic sur-

veys have been extensively used as a guide to possible alluvial-covered deposits.

The ore deposits of the Twin Buttes district are similar in many respects to those developed in the Pima district. The ore shoots lie along a fault zone in metamorphosed sediments adjacent to a zone of garnet rock. Small fissures that originate at a granite contact and cut the sedimentary rocks appear to have been controlling factors in ore deposition.

Long-Hole Prospecting

To outline ore shoots from underground workings, Banner makes extensive use of long-holing methods. Using Coromant rope thread, sectional steel and a 1 7/16-inch, chisel, tungsten carbide bit, the company has regularly drilled holes 100 feet deep to test both walls. The cuttings from each 5-foot section of hole are collected for assay. In order to facilitate recovery of the long-hole sludge, a short drill hole is collared below the long-hole and intersects the latter at a depth of 1 foot. A short length of pipe is then inserted in the collecting hole and protrudes far enough from the collar so that a bucket can be put under the pipe to collect the sample. In one long-hole campaign at the North Daisy, remarkably accurate results have been obtained using this

These Supervisors Direct Company Activities

A. B. Bowman	Vice President & General Manager
F. C. Prince	Chief Accountant
B. W. Venable	General Mine Superintendent
Wm. Anderson, Jr.	Mine Superintendent
Frank Horton	Mill Superintendent
A. P. Holzworth	Mine Foreman—Twin Buttes Mines
E. C. Bowman	Chief Clerk
F. D. MacKenzie	Geologist
Alton Young	Mine Surveyor
Ed Stowell	Health & Welfare
Paris V. Brough	Metallurgist
Ramon Miranda	Chemist
John Diffie	Safety Inspector
E. E. Bray	Master Mechanic



LONGHOLING yields fairly reliable results regarding grade at Banner's mines. This photo, taken at the Daisy mine, shows typical set-up. Equipment consists of a Gardner Denver drill with Coromant rope thread steel and chisel bit.

method. During this project holes were drilled on 50-foot centers a distance 50 to 80 feet through an ore body from both sides of a drift heading. Three-inch airleg machines were used for this work. The cuttings were collected for assay, and a composite assay was determined for each hole. Later, cross cuts were driven along two of the long holes, and all the ore taken from each crosscut was sampled and assayed. In one case the composite crushed ore assay was .02% Cu higher than the composite long-hole assay. In the second case the crushed ore assay was 0.11% Cu lower than the figure obtained by long holing. This experience indicates that long-holing will yield fairly reliable results regarding grade at Banner.

Mineral Hill Development

Though the Mineral Hill mine had been developed to the 700 level, it had been idle for nearly 30 years and had to be unwatered. Daily output from this mine has grown to 400 tons since the mine was reopened in 1953.

The Mineral Hill mine is developed by two shafts both of which were rehabilitated prior to exploration of the underground workings. A vertical, two-compartment shaft bottoms just below the 500 level and is now used for lowering men and supplies. A two-compartment, inclined shaft, at a 54° angle to horizontal, is used for hoisting muck. Levels are established at the 300, 500, 600, and 700-foot depths below the surface. The inclined shaft bottoms 100 feet below the 700 level. Since actual production at the mine started in 1953, most of

the ore has been obtained from the 300, 500 and 600 levels. The 700 level, however, is becoming increasingly important, and in the future operations will be concentrated at the lower level.

A great variety of rock types are noted at the Mineral Hill mine. These vary from very soft and weak brecciated material, containing considerable chlorite and gouge in the vicinity of cross faults, to a metamorphosed, impure limestone which will stand open over one mining floor to widths of 25 feet or more. The stoping pattern was governed to suit the requirements of the ore body regarding size, shape, and type of host rock.

Various modifications of shrinkage stoping were originally tried.

Sand Fill Plant

Shrinkage stoping has been largely abandoned in favor of cut and fill methods. Fill is provided from de-slimed mill tailing prepared at an installation erected at the collar of the Mineral Hill muck shaft. This installation also serves the Daisy mine 3,500 feet away.

This batching plant consists of two, 10-inch Krebs cyclones mounted on top of a 14- by 16-foot tank containing a propeller for agitation, two steady head sumps, and two Wemco 3-inch centrifugal pumps. Mill tailing (25 percent solids) is pumped from the mill to the two sumps at the hydraulic fill plant by two Wemco 5-inch pumps. Each Krebs cyclone is fed at a pressure of 30 pounds per square inch by the Wemco 3-inch pump on each sump. A steady level is maintained at the pumps by closing the sump-pump-cyclone circuit by returning the cyclone overflow to the sump. This maintains both sumps near the overflow level and provides a more efficient cyclone operation. Sump overflow is piped back to the mill tailing thickener for disposal at the pond. The de-slimed tailing in the tank (cyclone underflow) is agitated by a Wemco propeller to prevent sands from settling.

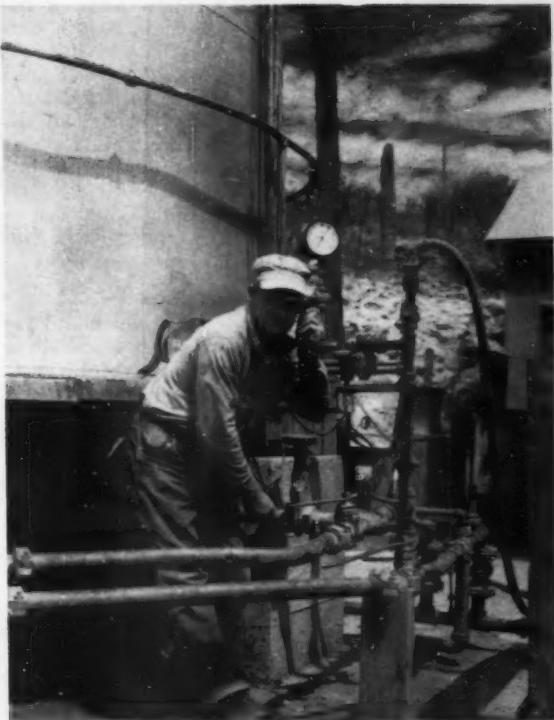
Separation of the tailing in the cyclone provides an underflow containing 75 percent solids; the overflow contains about 9 percent solids and screens 90 percent minus-325-mesh. The cyclone sands contain approximately 10 percent minus-325-mesh. This percentage of fines is desired in the backfill.

The sand line entering the Mineral Hill mine contains a rubber pinch valve and this is the only valve in this line. The fill is introduced to the Mineral Hill mine by means of a 2-inch pipe containing Victaulic couplings. Backfill for the Daisy mine flows by gravity from the hydraulic plant at the Mineral Hill ore shaft through a 3,500-foot long, 3-inch pipeline on an average grade of 3 percent.

The tank at the sand plant has a capacity of approximately 50 tons of de-slimed tailing. Two men are required for the filling operation. One is at the surface and the other is at the stope being filled. They communicate by means of Signal Corps telephones. The hydraulic fill line contains a connection near the discharge of the tank so that it can be flushed with com-



TYPICAL slusher set-up in stope shows Ingersoll Rand, 15-hp., double drum hoist and Pacific 36-inch bucket.



TWO MEN are required for filling operation—one at the surface batching plant, shown above, and one underground. Communication is by Signal Corps typed telephone.

pressed air and water following a stope filling operation.

Cut and Fill Stoping

Two general methods of cut and fill are employed. One is a horizontal cut and fill in stopes which are transverse to the strike of the ore body. Another consists of square-set timbered slot stopes with horizontal cut and fill mining of a 20-foot pillar between the timbered slots.

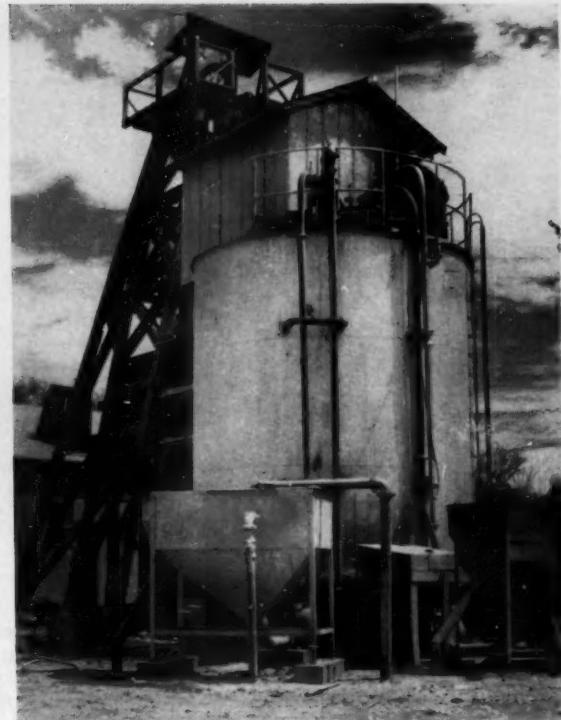
In the transverse horizontal cut and fill stope, chutes are placed at 35-foot centers. Two-compartment raises are driven to the ore at a 70° angle. When the ore is reached, the raises are driven raw at a 35 to 45° angle to the next higher level. An I-drift is driven from footwall to hanging wall at the top of the timbered drift, and the ore slushed to chute with an electrically powered Ingersoll-Rand, 15-horsepower, double-drum hoist and a Pacific 36-inch scraper. The I-drift is slabbed out to a 25-foot width. The cribbed chute and manway is then raised forming a chimney above the stope floor. The stope is filled to within two feet of the back and then a new floor is started from the raise. The de-slimed mill tailing packs so rapidly that a stope filled on one shift can be worked the following shift. The backfill introduced to the stopes

contains about 75 percent solids.

The cribbing carried above the fill contains a manway and chute compartment. The manway is cribbed with 3- by 12-inch timber. The chute is cribbed with 6- by 8-inch timbers. The inside edge of each cribbed ring in the chute compartment is protected



FILL is introduced underground through a 2-inch line. Pipe is flushed with water and air after stope is filled.



HYDRAULIC BACKFILL PLANT consists of two Krebs, 10-inch cyclones, a 14-by 16-foot tank, two steady-head sumps and two Wemco, 3-inch centrifugal pumps.

by 3- by 2- by $\frac{1}{4}$ -inch irons. Cribbed rings are sealed by burlap which is stapled to the timber and also by applying a quick setting cement.

Most of the stope drilling at the Mineral Hill mine is done with Gardner Denver airleg machines, however some Thor and Copco machines are used. The steel is $\frac{1}{4}$ -inch hexagonal and is fitted with threaded 1 $\frac{1}{8}$ -inch Ingersoll Rand Carset bits.

In the upper portion of the ore body on the 300 level, combination square-set and cut and fill stoping has been used. This was done primarily in ore bodies with a horizontal width of up to 30 feet and where the ore did not continue to the level above. These stopes were run without service raises between connecting levels. The method consists of driving square set slot raises or stopes on 30-foot centers along the strike. The slots are two sets wide and extend from foot to hanging wall. The 20-foot pillar remaining between adjacent slots is mined as each timbered floor of the raise is completed and gob-lagged. This method has been used where the ground is extremely bad. Sand filling has been introduced in a stope of this kind as high as 145 feet above the sill of the haulage level. The solids content of the fill had to be reduced to reach this height, however.



TRAINLOAD of ore reaches the 700 level shaft pocket. The ore drawn from the stopes is trammed to the station by an Atlas 1.5-ton battery locomotive pulling 19 cubic-foot-capacity rocker-dump cars mounted on C. S. Card trucks.

Broken ore is hauled to the Mineral Hill shaft pocket stations on the 500, 600, and 700 levels in 19 cubic-foot-capacity rocker-dump cars. The mine cars are fabricated in Banner's shops at Lordsburg, New Mexico and mounted on C. S. Card car trucks. Drift and development headings are tracked with 16- and 20-pound rail on 18-inch gauge. Trains are powered by Atlas 1½-ton battery locomotives. Chutes at the shaft pockets and measuring pockets are equipped with compressed-air operated doors.

Ore and waste are hoisted up the 54° incline in 2.5-ton-capacity, self-dumping skips also made in Banner's Lordsburg machine shops. The muck shaft is equipped with a 250-horsepower, double-drum, Vulcan hoist; rope speed during ore or waste hoisting is 700 feet per minute. The headframe of the muck shaft contains a 100-ton ore bin and a 50-ton waste bin. The Mineral Hill muck shaft is located adjacent to the mill and ore is trucked 100 yards to a drying area at the coarse crusher.

Daisy Discovery

The Daisy mine, now developed by a small vertical 2 compartment shaft and four levels, currently produces about 300 tons per day. It is sometimes referred to as the mine containing an ore body that was found by one drill hole. Actually it wasn't as simple as all that. Exploration to the east of Mineral Hill had been carried out in the hopes of adding to ore reserves. Geophysical work had been done northeast of the present Daisy shaft site, and anomalies had been found. In checking out these anomalies, pre-

liminary drilling had disclosed a high grade copper orebody. The next step in this campaign was to look for a shaft site from which underground exploration and further drilling could be conducted. In drilling a site for the proposed prospect shaft, high-grade, oxidized ore was encountered only 35 feet beneath the surface alluvium in the drill hole. A small shaft was sunk so that the oxidized zone could be prospected. This shaft was later extended and became the opening from which the Daisy mine was developed. The levels are located on 100, 215, 330, and 430-foot elevations below the shaft collar. Some 45,000 tons of about 6 percent copper ore was mined from the oxidized zone.

Structural conditions at the Daisy are similar to those found at the Mineral Hill mine. The ore occurs in a zone of thrust faulting and is localized in the boundary area between a footwall limestone and a hanging wall arkosic quartzite. Underground development at the Daisy disclosed another larger parallel structure to the north of the original find. Projection of dips on the two parallel structures show that they have a possibility of converging at depth.

Dry Filling Was Used

Mining methods at the Daisy are similar to those used at the Mineral Hill. Up to the first of 1957, however, fill for stopes at the Daisy consisted of dry arroyo sand introduced to the mine from surface bore holes. The bore holes were put down by churning a pilot hole 10 inches in diameter followed by reaming to 20 inches. The top of the finished hole

is fitted with a grizzly made of 20-pound rails spaced on 10-inch centers. Backfill was gathered from arroyos around the property and piled at the hole. It was then bulldozed into the borehole as required by the mining cycle. This dry fill was spread in the stopes by slushers. De-slimed mill tailing is now used for back fill at the Daisy following completion of a pipe line from the Mineral Hill batching plant in January 1957.

Glance Re-Opening

The Glance mine in the Twin Buttes district was first examined in 1951. Actual unwatering of this shaft which had been sunk to a 625-foot depth started in August 1951 about one month after Banner started reopening the Mineral Hill mine. A connecting crosscut was then driven to the Copper Queen mine located 1,400 feet northwest of the Glance. Banner mined about 5,000 tons of shipping grade copper ore during this early period.

During 1955 and 1956, a 7-square-mile area in the Twin Buttes district was outlined for a geophysical survey and this work was contracted to United Geophysical Company. Magnetic surveys were run and anomalous areas were re-checked by electromagnetic means. Some geo-chemical work was also done in the area. As an up-shot of this work and further drilling of one big anomalous area, the Glance mine was developed for production.

Stoping actually started at the Copper Glance near the end of April; limited production of ore for stockpile was obtained from development headings as early as August 1956. Four stopes have been readied for cut and fill mining. This method of extraction, however, is subject to change as experience is gained with ground conditions during operations. Since the Glance mine is located seven miles from the mill, dry backfill will also have to be used. The method of introduction will be similar to that in practice at the Daisy mine before introduction of de-slimed tailing.

Banner has managed to expand mining facilities in the Pima and Twin Buttes districts while maintaining an income from existing production. Its growth has not been spectacular, but it has been steady. At the same time, development and exploration expenses have been in line with income. Experience has been gained regarding ore occurrences, and recent exploration in the vicinity of the Daisy mine has met with considerable success. There are indications of a large, low-grade copper ore body which may foreshadow the pattern of future development.

THE END



CROWD AT URANIUM Reduction dedication at Moab, Utah hears Jesse Johnson, director, Division of Raw Materials, United States Energy Commission, report that this mill was second largest producer of yellow cake in world during first six months of this year.

Moab Ceremonies Dedicate World's Second Largest Uranium Producer

Uranium Reduction Company, second largest yellow cake producer, both in the United States and in the world during the first six months of this year dedicated its new Moab, Utah mill on September 14th. This mill accounts for about 25 per cent of domestic production.

The new mill, the dedication ceremony, and the emergence of the United States as the world's largest uranium producer have been the direct result of Charlie Steen's discovery of

the now famous Mi Vida mine in Utah's Big Indian district in July 1952. Right from the discovery Charlie and his later associates wanted their own independent mill to treat their ore. They succeeded, too, despite years of all kinds of trials and problems. Charlie himself termed them as "almost insurmountable odds. No historian will ever relate the complete details of the battles that were fought in the offices and board rooms of bankers, lawyers, and public offi-

cials in Moab, Salt Lake City, Grand Junction, New York, Washington, D.C., and other places at all hours of the day and night." So you see the mill is first of all a tribute to Charlie.

Uranium Reaches Respectability

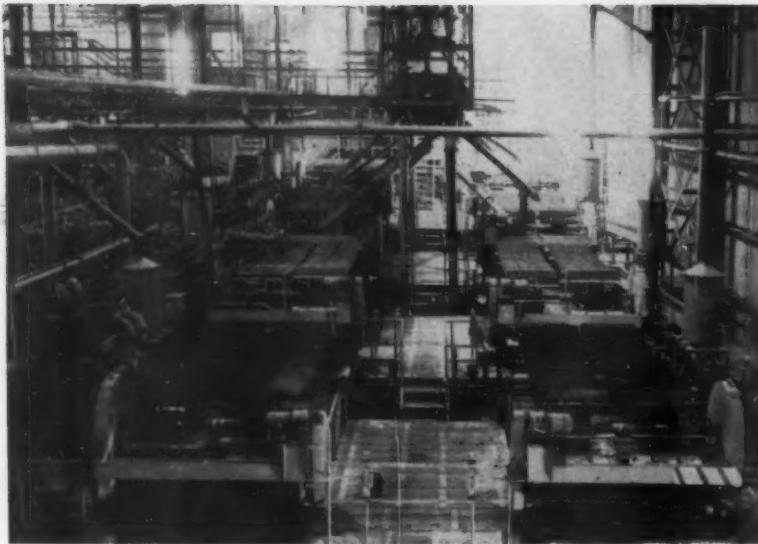
It is also a proud achievement of Edward H. Snyder and Combined Metals Reduction Company to whom Charlie first turned for assistance when he needed help in negotiating an Atomic Energy Commission con-



DEDICATION DAY, a proud event for the Steens, Mrs. "M. L." and Charlie sit with E. H. Snyder, who guided Uranium Reduction through difficult days, and Jesse Johnson of AEC.



CHARLIE'S DIAMOND DRILL, proudly parked at ceremony, started it all back in July 1952 when the diamond bit hit the world's first 1,000,000-ton-plus uranium ore body.



SAND-SLIME SEPARATION in mill follows sulphuric acid leaching. Slime goes to Resin-In-Pulp circuit for uranium recovery. This photograph shows the Colorado Iron Works Esperanza classifiers and Krebs cyclones used for sand-slime separation.

centrate contract, designing and operating the mill, and financing the project. Uranium Reduction Company was formed by Messrs. Steen and Snyder to do this. Mitchell Melich, Moab attorney, secretary of Utex Exploration Company, and now president of Uranium Reduction, played an important part in all negotiations.

Foley Brothers, Inc. was awarded the mill construction contract and agreed to help with the financing. Kuhn, Loeb & Company; New York Life Insurance Company; and the Chemical Corn Exchange Bank of New York City all participated in financing. Incidentally this was the first uranium mill ever financed by banks, insurance companies, and investment firms from New York City. This was the first proof that the uranium mining industry had reached financial respectability.

American Zinc, Lead and Smelting Company also bought stock in the company and contracted to build and operate the mill under the direction of American Zinc's president, Howard I. Young. Richard A. Young, vice president of American Zinc, as executive vice president of Uranium Reduction, has been in charge of operations.

In June 1955 the AEC contract had been approved, the mill was financed, and construction started. Combined Metals Reduction Company and Knowles Associates of New York designed the mill. Operating results, better than anticipated, are proof of the fine work of these two firms. Construction of the mill was accelerated from the start under the direction of J. W. Burgess, chief engineer of American Zinc, so that first ore was processed on October 4, 1956.

During mill construction Floyd B. Odlum's Atlas Corporation's subsidiary, Hidden Splendor Mining Company, acquired control of large ore reserves in the Big Indian district. By purchasing 30 percent of the common stock of Uranium Reduction, Hidden Splendor secured a market for its ores. Uranium Reduction gained, too, by assurance of additional ore reserves and financing, on call, as needed.

In brief form that's the history of Uranium Reduction.

Charlie Started It

Jesse Johnson, director, Division of Raw Materials, United States Atomic Energy Commission, in making the formal dedication speech, said that the mill was the culmination of a new era in uranium exploration, that Charlie Steen found the first 1,000,000-ton-plus ore body, and it was the first major discovery, by drilling, where the ore body had no outcrop. As part of the ceremony, Charlie proudly pointed to an old flat bed truck on which was mounted a short welded pipe mast and said "that's the drill with which I found Mi Vida." What a contrast to the new \$9,000,000, 1,500-ton-per-day mill. But, Charlie will always keep that drill, for he's more proud of it than the mill.

As for the mill, Mr. Johnson said that it was treating more than designed capacity with a recovery of 90 percent plus at lower than expected cost.

Proof that uranium milling is big and important business are the following facts: This year more than 540,000 tons of ore will be milled using \$5,000,000 worth of supplies including 2,455 railroad tank cars of sulphuric acid, 9,025 tons of nitric acid, and 1,825 tons of anhydrous ammonia to recover 3,400,000 pounds of U_3O_8 valued at more than \$25,000,000.



DEAD HORSE POINT BARBECUE was the start of the ceremonies for the official dedication of the Uranium Reduction Company's mill on September 14th. Part of the crowd flown to



Moab from all parts of the United States is shown at left. At right another group looks southward over Uranium Land with the storm clouds over the La Sal mountains.

"The Porphyry Coppers In 1956"

This is the second edition of the famous *Porphyry Coppers* which was published in 1933 and covered the period from 1905 to 1931. Dr. A. B. Parsons brings his book up to date for the period 1932 through autumn of 1956 and adds the "new" properties since brought into production. These are: Weed Heights (Yerington), "new" Morenci, Bagdad, Consolidated Coppermines, Silver Bell, Lavender Pit, Castle Dome, Copper Cities, and San Manuel. The changes and developments at the original 12 porphyries—Utah, Nevada Consolidated, Braden, Morenci, Miami, Ray, Chino, Inspiration, New Cornelia, Copper Queen, Andes, and Chuquicamata—have been outlined in detail.

What is porphyry copper? This is answered by Dr. Parsons who says that any property that meets the following conditions is a porphyry: The deposit is large and so shaped that it can be mined to advantage by large-scale low-cost methods. Copper minerals are so evenly distributed that it is more profitable to mine by bulk than selection. An intrusion of a porphyry or closely related rock has played a vital part in ore genesis. Secondary enrichment has concentrated the copper. Secondary enriched zone is underlain by primary zone.

The 261-page book has 27 tables dealing with costs, ore reserves, equipment etc. There are also 36 figures, maps and flowsheets, and numerous pictures. Price is \$5.00 from AIME, 29 West 39th Street, New York City.



BAGDAD. . . . "Because of topography and the shape and disposition of the ore bodies, they are not as amenable to cheap mining as are most of the porphyry deposits. . . . Nevertheless, mining problems appear to be surmountable; and both classes of ore are amenable to established methods of treatment."



SAN MANUEL. . . . "Perhaps the outstanding engineering feature is the mining of 33,000 to 35,000 tons of ore per day (a six-day production week is scheduled) by the method known as the underground block caving. From the standpoint of tonnage, this exceeds anything ever before attempted."



WEED HEIGHTS. . . . "A few of the somewhat unusual features of the operation . . . chrysocolla is the chief copper mineral . . . probably the first porphyry to replace churn drills with rotary drills for boring blastholes."



CHINO. . . . "It is safe to venture the opinion that in 1955 Chino was the second best of Kennecott's copper mines in the United States; and that it still has ahead of it a long and successful future."



INSPIRATION. . . . "Among the features that make Inspiration of outstanding interest, particularly to the engineer, is the fact that at various times it has used, as a major method of production, three more or less distinct methods of mining and three distinct methods of treating its ores."



CONSOLIDATED COPPERMINES. . . . "The first Coppermines production was in 1926 pursuant to a 25-year contract with Nevada Con . . . the contract provided for mining by each company of certain of the others' ores . . . and by Coppermines through some of its underground workings."



MESTERS VIG, GREENLAND, one of the world's most northerly mining camps, as it looks for nine months of the year. This picture was

taken by the light of the moon during mid-winter. The lead-zinc mine and 360 ton per day flotation mill are all underground.

Greenland Lead-Zinc Mine Beats Elements With Underground Mill

By BERTIL ASTLIND..
and P. H. FAHLSTROM

One of the world's most northerly mining and milling operations is now in its second year of lead and zinc production. The Northern Mining Company has successfully solved the difficult problems of location, adverse climate, transportation for only a few weeks of the year, and a natural shortage of labor of any kind, water, fuel, timber, etc.

Yes, there's just one place in the northern hemisphere where these conditions prevail. It is Greenland where lead-zinc was discovered in 1948; exploration was started in 1952; a major

ore body had been developed by the end of 1954; and a 360-ton-per-day differential flotation mill was built and placed in operation in March 1956.

Greenland was discovered in 982 A.D. by the banished Icelandic farmer, Erik the Red. It is the largest island in the world—736,518 square miles—but its ice-free area is only 110,000 square miles. With the exception of the southwest part, the coast is isolated by ice for most of the year (mostly drift ice from the North Pole). This condition makes shipping very difficult and dangerous, hindering exploration and development of the country.

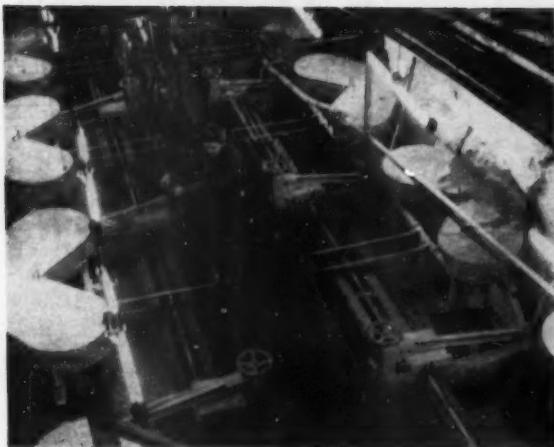
The man who has been the most active in studying the geology and ore-mineral possibilities in east Greenland is the Danish geologist, Dr. Lauge Koch. After more than 20 years of geological mapping, he organized an ore prospecting expedition in 1948. An occurrence of lead and zinc ore at

Mesters Vig in the northeast corner of Scoresby Land ($72^{\circ} 15' N.$) was soon discovered. The following year, the Blyklippen vein was found, which proved to be one of the most promising in the area.

The problem of raising capital for a mining venture in a waste area which was open to shipping only a few weeks in the year was solved by Per Kampmann of Copenhagen, one Airlines System. He succeeded in interesting the Danish government, Danish industries, and three foreign mining companies (Boliden Mining Company, Stora Kopparbergs Aktiebolag of Sweden, and Ventures Ltd. of Canada) in a partnership. Northern Mining Company was founded by the group with Mr. Kampmann as president of the board.

In August 1952, ships arrived with men, bulldozers, graders, scrapers, equipment for diamond drilling, compressors, other mining equipment,

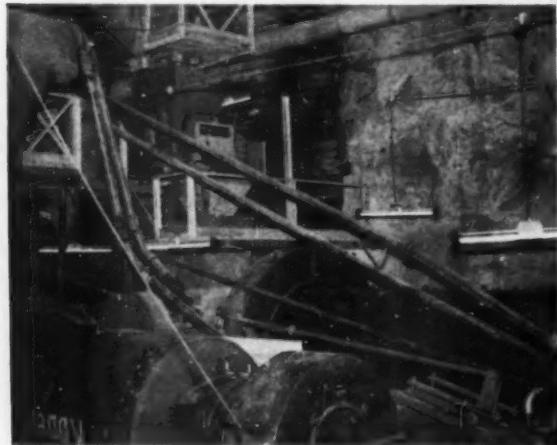
Mr. Astlind was local manager for the Northern Mining Company during construction and initial operation at Mesters Vig. He now is technical manager for Türk Minedon Cirketa, a large Turkish mining firm. Mr. Fahlström was consulting metallurgical engineer for Northern Mining Company. He did metallurgical test work and designed the mill flow sheet.



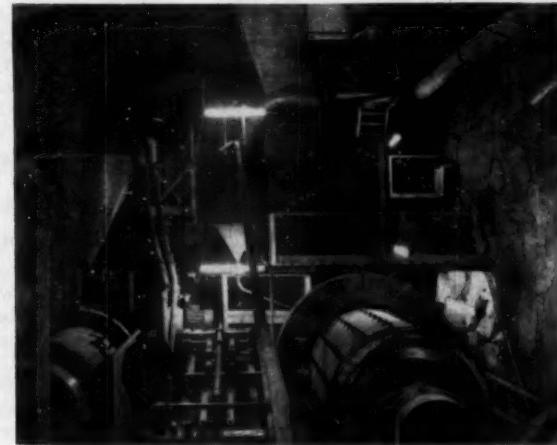
BOLIDEN double flotation cells using low pressure air are used for both the lead and zinc circuits. Eleven cells in each circuit are set on 18° slope for gravity flow.



WORLD'S NARROWEST and longest flotation mill was excavated from solid rock. It is 200 feet long and only 20 feet wide. Lead and zinc cells are on opposite sides.



LEAD-ZINC MIDDLING is reground in the tube mill in the foreground. These middlings from the flotation circuit are pumped back to the mill rather than to primary rod mill.



GRINDING is done in the 6- by 12-foot grate discharge rod mill at right. Water shortage makes classifier overflow as dense as 1.2 parts water to 1.0 sand necessary at times.

building material, dynamite, and supplies for one year's work. A new life started on the boundless fields where musk oxen, polar foxes, and snow-hares had earlier ruled alone.

The first task was to build an airport, which is a necessity for continuous mining. It was ready for the first landing in two months. Simultaneously, a 1,400-yard-long road was built from the coast and the airport to the mine site.

At the mine, diamond drillers started their work and miners drove adits from the slope of the "mine-of the organizers of the Scandinavian mountain."

In place of the earlier tent camp, a new camp was built with wooden houses containing an office, hospital, workshop, crew houses, warehouses, and a canteen.

By the autumn of 1954, the ex-

ploration was finished at Blyklippen. About 2,500 yards of tunnel had been driven, 100 diamond drill holes completed, and more than 2,000 samples had been cut and assayed. The board of directors passed a resolution to prepare the mine for production and decided to continue the prospecting for unknown ores in the area.

The oldest rocks in the immediate area are a sequence of sediments, consisting chiefly of medium to coarse sandstones. Their age is fixed by plant remains in some of the horizons as being Upper Carboniferous. The greatest exposure of igneous rocks is syenite at the Verner Bjedge. The age of this intrusive mass is definitely Post-Triassic.

As a result of igneous action, dikes and veins of syenite, basalt, and quartz penetrated the sedimentary rocks. The most interesting of these are quartz veins which are sometimes

accompanied by barite and sulphides of lead, zinc, and, rarely, iron and copper.

At Blyklippen, a lead- and zinc-bearing quartz vein with a width of 7 to 40 feet cuts the almost horizontal sandstone layers. It dips 60° to 80° and outcrops 1,670 feet above sea-level. The bottom of the nearby valley is at 1,000 feet and the ore is certainly established at 1,380 feet above sea-level.

Cut and Fill Mining Method

Plans for the mining of the ore were made by Karl Johansson, M.E. of the Boliden Mining Company of Sweden, who also worked for the company as a consulting engineer. He stated that cut-and-fill mining is the most proper method for this kind of ore deposit. Shrinkage and similar methods are impossible because of the weak hanging wall, and the risk of



BERTIL ASTLIND
First Manager



P. H. FALSTRÖM
Consulting Metallurgist

the broken ore becoming frozen solid in the stope. The width of the stope is the same as the vein width. It is intended to use as pillars barren or low-grade parts of the vein as extensively as possible. The filling material is taken from the scree and the hanging wall on the surface. In connection with fill caving, the apex of the ore will be mined in an open pit.

For drilling, light Atlas Copco machines are used with $\frac{1}{2}$ -inch tungsten carbide tipped drill steel. As the rock temperature in the orebody is below zero, it is necessary to use pre-warmed water for drilling. This is pumped from the engine cooling system in the power and compressor station.

The broken ore in the cut-and-fill stope is scraped with 45-inch scrapers, pulled by 40-horsepower slusher hoists.

Timber is very expensive material in Greenland—the domestic tree-trunks are less than one inch in diameter; therefore, the ore passes are made of steel plating formed as jointable cylinder sections.

The ore is hauled on the main level 1,380 feet above sea-level in Granby cars to an underground crushing station.

Pilot Plant Ore Testing

The broken ore contains 70 to 80 percent worthless gangue minerals and, because of the high shipping costs, must be concentrated at the mine.

The ore minerals occur mainly in coarse-grained aggregates of galena and sphalerite. Oxides, sulphates, and carbonates of lead, zinc, iron, and copper can be found in weathered parts of the ore body. Some parts of the vein are rich in barite; clay occurs along the hanging wall and usually in the very metamorphosed basaltic dikes which, in places, cut the veins.

Laboratory tests and small-scale separation in the pilot plants belonging to Boliden Mining Company showed that the most common type of

ore could be concentrated by jigs and tables, alone, or in combination with flotation. In view of the isolated location of the mill, it was desirable to choose only a few types of well known machines, thus eliminating the need for numerous and varied spare parts.

Finer grained types of ore can also be expected to occur in some parts of the vein, or in other veins in the district. Therefore, a conventional type flotation plant was planned since very good results had been obtained from the flotation pilot plant.

Water Problem

A problem to be considered was the shortage of water during the winter. Between December and April the little stream in the valley could only yield 40 to 50 United States gallons per minute. As this water must also be used for drilling and for the camps, the greatest economy of water usage was extremely necessary. Therefore preparations were made for filtering the pulp after lead flotation and returning the water to the lead circuit; also for filtering the tailing and return-

ing the filtrate to the zinc circuit. Water is also reclaimed from the thickeners.

Theoretically, only the water in the filtered concentrates and tailing should go to waste, but, of course, this ideal minimum consumption is impossible to perfect. The filtering of tailing was particularly complicated by clayish ingredients during the first month of production, March 1956.

The open landscape and hard winds of Greenland make outdoor stockpiling of concentrates very uneconomical. To build adequate warehouses or storage silos is very expensive, however; therefore, it was decided to sack the concentrate and to store these sacks in the open air on pallets. Experiments are also being made on briquetting the concentrates.

All the Plants Underground

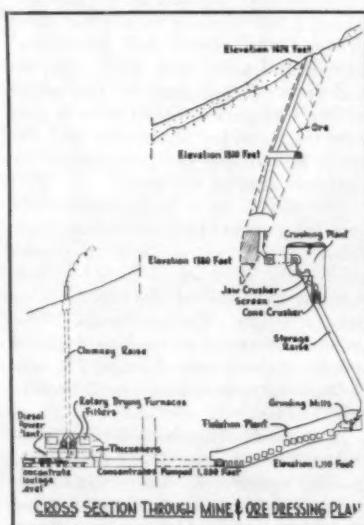
A plant with buildings of the conventional type has many disadvantages in the arctic. Mesters Vig has an annual mean temperature of 19° F. and during the period between December and February a mean temperature of Minus 4° F. The water from the stream has a winter temperature of only a few tenths of a degree above freezing point.

The perma-frost condition of the ground causes other building problems. The thin surface skin that thaws in summer acts, in places, as a fluid substance twisting and cracking any foundation. To the above-mentioned local disadvantages must be added the high transportation costs of building material.

It had been established that under the known ore body the sandstone rock had a natural temperature of 34° F. and that its structural strength was probably rather good. No better place for the mill than in the "warm" rock could be found. Boliden Mining Company's chief designer, C. Bürström, and his staff started to design a mill with crushing, grinding, flotation, thickeners, filters, drying furnaces, Diesel power plant, and air compressors to be installed in chambers cut in the solid rock.

Designing was finished in January 1955 and room excavation started in February. The necessary mining of 460,000 cubic feet of sandstone was completed in August when the ships arrived with the machinery for the mill. One year after excavation started—in February 1956, the mill was ready for production.

The only differences a visitor can see in the Store Blydal (Big Lead Valley) between February 1955 and February 1956 are the dumps of sandstone on the hillside, a chimney for exhaust gases, and a large oil tank.



Later he will see the increasing stock of sacked concentrate.

Crushing Plant

The crushing plant has been excavated so as to join with the haulage level. It has two crushers—one jaw-crusher and one cone crusher—with a screen between. Here the ore coming directly from the mine cars is crushed to minus-1-inch. The machinery was delivered by Morgårdshammar Mekaniska Verkstad, Aktiebolag, Sweden. The crushed ore is stored in an ore-pass raise, having a 24-hour mill capacity, blasted between the crushing and the flotation chambers.

Grinding-Flotation Chamber

The flotation chamber is a 200-foot-long room inclined at 18°. Farthest from the entrance, and highest, are the two mills—one rod mill for primary grinding and one tube mill for regrinding of middlings from flotation. They were manufactured by F. L.



Smith & Co. A/S, Copenhagen, Denmark.

For flotation, 11 double cells are

used for lead flotation and the same number for zinc flotation. They are of Boliden manufacture with impeller and low pressure air and are similar to the majority of the flotation equipment delivered by Sala Maskinfabrik AB, Sweden.

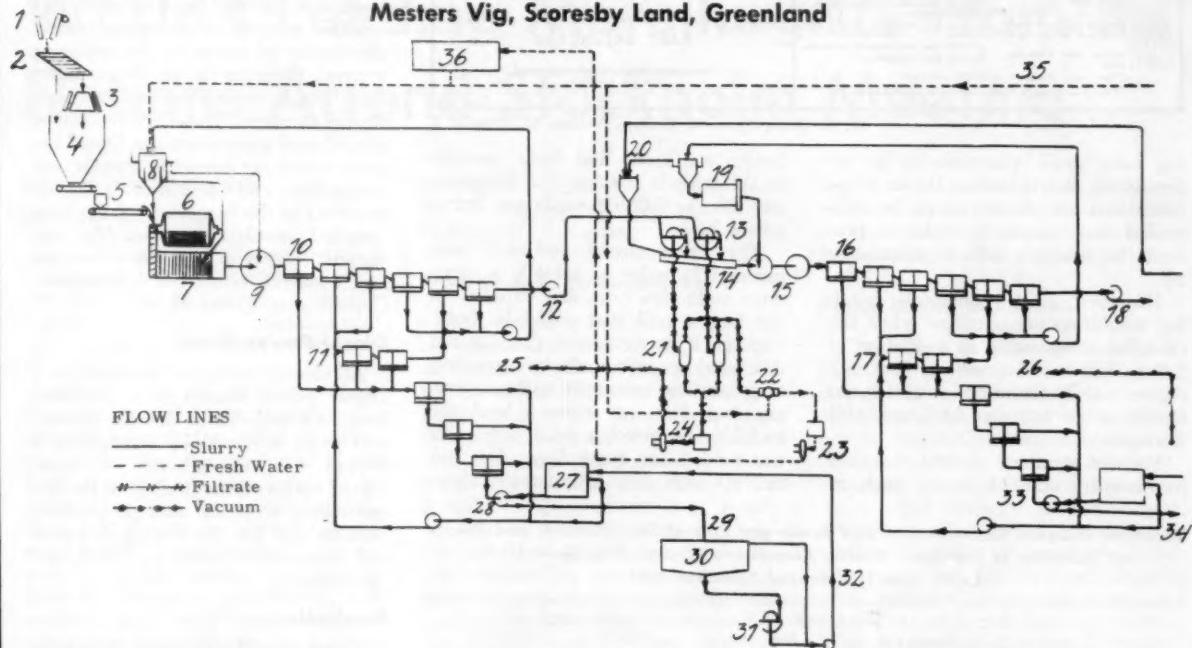
In adjoining rooms to the flotation hall there are filters for water recovery ventilators, pumps, and a water reservoir. There are also special rooms for the storing and preparation of reagents.

Unique Primary Grinding Circuit

The 6-by-12-foot grate discharge rod mill grinds the ore from 15 percent plus-1-inch to 5 percent plus-48-mesh and 45 percent minus-200-mesh in one step. Although there is one 4-by-20-foot rake classifier in closed circuit with the rod mill, the mill usually is operated in open circuit by adjusting the water to the classifier. At times of water shortage, dilution of overflow from the classifier is as low as 1.2 parts to 1.0 part of solids, caus-

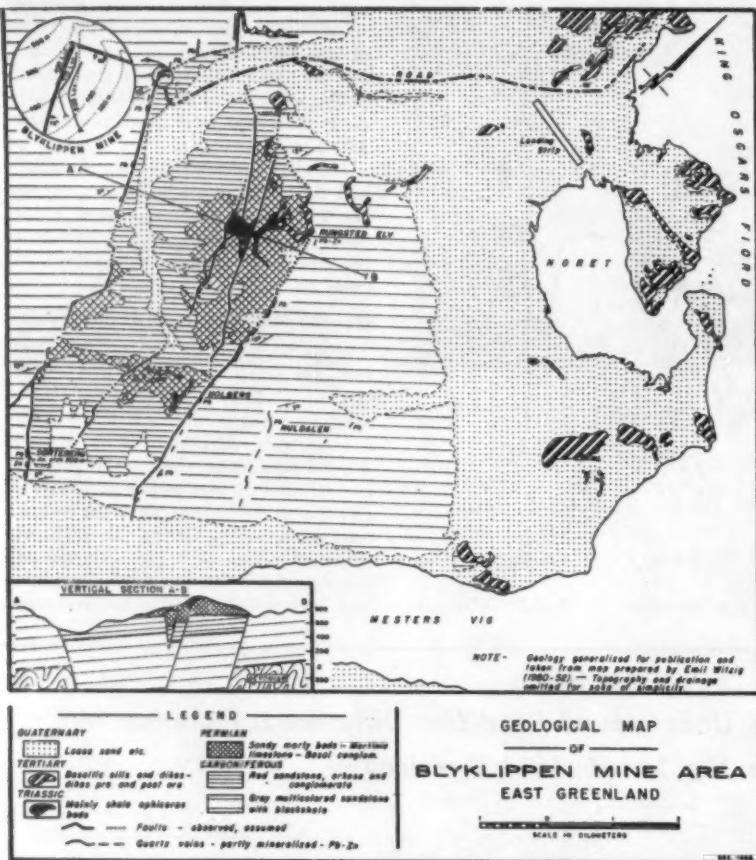
Flowsheet

Northern Mining Company's Underground Lead-Zinc Differential Flotation Mill Mesters Vig, Scoresby Land, Greenland



1. Jaw crusher, Morgardshammar No. 5.
2. Vibrating screen, 5 by 8 foot.
3. Symons crusher, 3-foot.
4. Fine ore storage, 350 tons.
5. Automatic feeder, Sala BM-250.
6. Rod Mill, 6 by 12 foot.
7. Rake classifier, 3 by 25 foot.
8. Automatic cones.
9. Agitators.
10. Lead rougher cells, six No. 2 Boliden BFP-120.
11. Lead cleaner cells, five No. 2 Boliden BFP-120.
12. Lead tailing.
13. Drum filters, two, 8 by 5 1/3 foot.
14. Chain repulper.

15. Agitators, two.
16. Zinc rougher cells, six No. 2 Boliden BFP-120.
17. Zinc cleaner cells, five No. 2 Boliden BFP-120.
18. Zinc tailing.
19. Zinc middling regrind ball mill, 4 by 8 foot.
20. Automatic cones.
21. Vacuum tanks.
22. Nash Hytor vacuum pump.
23. Fresh water pump and feedbox.
24. Fresh water pump and feedbox.
25. Reclaimed water added to lead froth launders.
26. Reclaimed water from zinc tailing added to zinc froth launders.
27. Water supply tank for pumping of lead concentrate.
28. Lead concentrate vertical slurry pump, Boliden BPV-350.
29. Pipe line for lead concentrate, 2-inch diameter 2,200 feet long.
30. Lead concentrate thickener, 13 foot.
31. Lead concentrate filter, 8 by 5 1/3 foot.
32. Pipe line for returning water to lead concentrate pump.
33. Zinc concentrate pump.
34. Zinc concentrate handling system.
35. Fresh water supply pipe line.
36. Fresh water steady-head tank.



W. H. Gross, *Economic Geology*, Volume 51, Number 5.

ing very small quantities to be returned by the classifier. Under these conditions the density must be controlled very closely in order to prevent the flotation cells from sanding up.

However, most economical grinding conditions are obtained when the classifier is operating at a dilution of 2.0 to 1.0 in the overflow. Rod mill capacity at 70 percent of critical speed is 360 metric tons per 24 hours. Mill horsepower is 180.

Rods of standard quality, 3 inches in diameter and 11 feet 1 inch in

length are used. Rod wear amounts to 2.7 pounds per ton (1.2 kilograms per ton, or 0.088 pounds per horsepower hour).

The open circuit rod mill was planned in order to achieve a maximum reduction ratio and capacity in the largest mill that could be built. Further, it was expected that the rod mill would permit a selective grinding of galena and sphalerite without overgrinding. For use when a lead-zinc middling occurred, a small tube mill was added for regrinding. The rod mill operates very satisfactorily along

the lines planned, resulting in extremely favorable flotation conditions.

Flotation

All reagents are added in solution from disc and cup feeders. Preparation and storage of solutions is in a special room below the flotation hall. The reagents are pumped continuously to the feeders and a small overflow circulates back to the storage tanks. Reagents used are listed in accompanying table.

Consumption of soda ash is high, due to presence of acidic iron salts. The pH in the lead circuit is maintained at 7.5.

The flotation results are excellent. Depression of sphalerite in the lead circuit is almost complete. Grades of concentrates and recoveries are high.

Exhaust Gases For Drying

The concentrates are pumped 1,200 feet in 2-inch lines to thickeners of the Dorr type. Each line is equipped with two Boliden vertical slurry pumps in series. The overflow from the thickeners and the filter water are repumped to the last cleaner cell froth launder to dilute the concentrates for suitable pumping density. A steady-head tank at the head of the froth launder is used to maintain correct circulation of water in the pumping system. Filtering is on drum filters from which the cake is fed to rotary drying furnaces. These are heated by the exhaust gases from the Diesel engines which are placed in a room next to the filter and furnace room. Manufacturers of the furnaces and the later installed ventilation system (the machinery tended to give the rooms too much warmth) was Glent & Company, Copenhagen, Denmark.

Diesel Power Plant

All electric energy is produced in a Diesel power station in a 180-foot-long rock hall. Three 350-kw generators were delivered by Burmeister & Wain's A/S, Copenhagen. As mentioned earlier, these machines, besides generating electrical energy, produce exhaust gas for the drying furnaces and warm water for the rock drill, and the camps.

Production

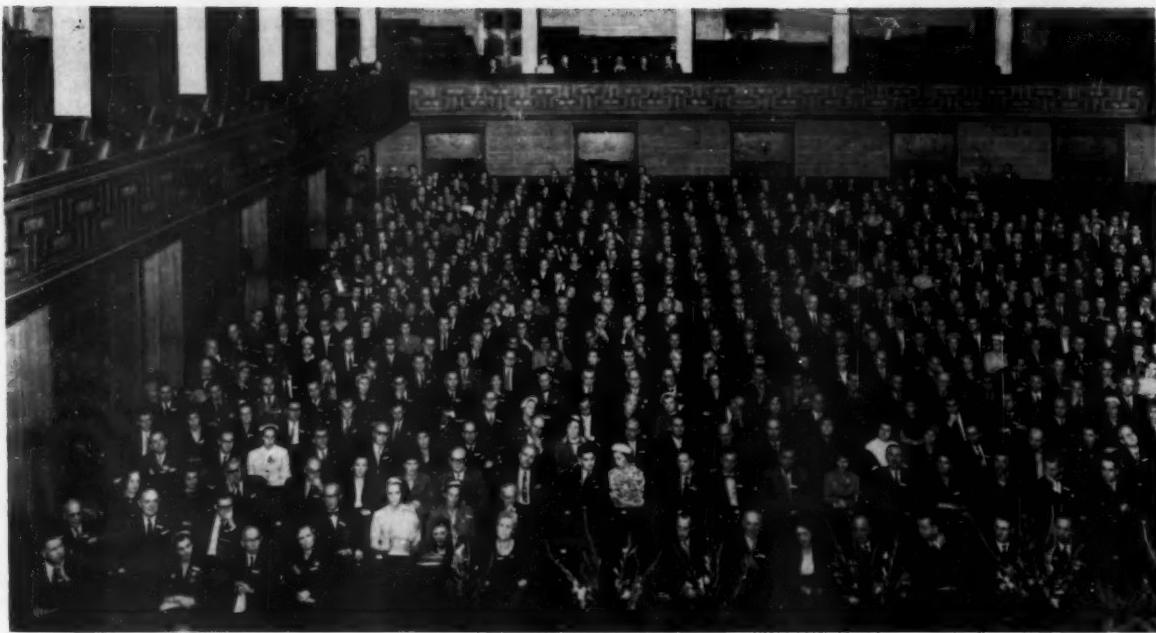
The mine will be worked 10 months a year, February to November, with an annual production of 80,000 tons of ore (15 tons per hour). During December and January when there is only a small supply of water and when the human physical trials caused by the very long night are bad, there is no production. Only the men necessary for maintenance and repair are left.

THE END

Flotation Reagent Consumption in Pounds per Ton of Ore Treated, and Points of Addition at Northern Mining Company's Mesters Vig, Greenland Lead, Zinc Differential Flotation Mill

Reagent	LEAD CIRCUIT		ZINC CIRCUIT	
	Pounds Per Ton	Point of Addition	Pounds Per Ton	Point of Addition
Soda ash	6.5	Classifier	—	—
Lime, slaked	—	—	1.5	Agitator
Sodium cyanide	0.1	Rod mill	—	—
Z-11-xanthate	0.16	Classifier, cells	0.22	Agitator, cells
Copper sulphate	—	—	1.1	Agitator
Pine Oil, Yarmour F	0.18	Classifier, cells	—	—
Dowfroth 250	—	—	0.08	Agitator, cells

NOTE: Mill heads averaged 8.1 percent lead and 8.4 zinc. Lead concentrate assayed 82.1 percent lead and 1.0 zinc. Zinc concentrate assayed 64 percent zinc and 0.4 lead. Tailing assayed 0.5 lead and 0.7 zinc. Lead and zinc in tailing was partly non-sulphide minerals.



OPENING SESSION of the International Mineral Dressing Congress is pictured in this lecture hall at the Swedish Royal

Institute of Technology. The meeting in late September drew metallurgists from all parts of world.

Ge-Be photograph

World's Leading Metallurgists From 33 Nations Attend Stockholm Meeting

By MAX F. HOLSINGER
General Manager

The International Mineral Dressing Conference held in Stockholm, Sweden September 18 through 21 brought together a galaxy of metallurgical talent from no less than 33 nations from both sides of the Iron Curtain. Qualified observers, including those from the United States, consider the meeting one of the most profound and productive ever conducted in the field of mining and metallurgy, to an extent that the loosely-knit group's plans to broaden its activities into a more formal organizational pattern, such as a permanent International Mineral Processing Association, will probably make considerable headway when the next meeting is held in London in 1960. The new president is J. E. Denyer, managing director of Cyanamid of Great Britain, Ltd.

The meeting in Stockholm was organized and sponsored by the Swedish association, Svenska Gruföreningen, directed by John Hedlund, who extended invitations to the respective metallurgical chairman society members in countries around the world.

Convention chairman was well known R. G. Kilstedt of Sweden's Royal Institute of Technology.

From Austria to Yugoslavia

Registration statistics, for what they are worth and may reveal, included delegations of: 20 Americans matched by an equal number of Russians; 109 Germans; 37 Frenchmen; large delegations from all of the Scandinavian countries; good showings from Japan and Southeast Asia. The United Kingdom group of 24 was nearly equalled by a serious-minded delegation of 21 Yugoslavs who reflected their enthusiasm concerning the progress being made in their richly mineralized country. Other representative delegations were on hand from all Satellite mining countries, and from areas as far as the Philippines, India, Iran, Morocco, and Turkey. Heading up the American delegation as honorary committeeman for the IMDC, and representing the AIME, was William B. Stephensen, president of the Allen-Sherman-Hoff Pump Company. Delegates maintained a near-90-percent attendance record over

three packed days of sessions, prefaced on the afternoon of September 18th by the formal opening ceremonies in Stockholm's concert auditorium.

Peace Doves at Banquet

Climaxing the affair was probably the most lavish and uniquely conducted banquet and dance ever staged for a mining gathering, in Stockholm's magnificent golden mosaic "Gyllene Salen" in the City Hall, scene of the Nobel prize awards. Place card settings at the dinner intermixed delegates of all countries, even to the point of separating wives from husbands. International relations and linguistic attainment were observed to reach new highs as waiters kept champagne glasses full. Noticeable after the affair were the number of small "peace-dove" pins in various delegates' lapels, having been tendered by smiling USSR delegates to their genuinely cordial western colleagues.

Following the formal meetings in Stockholm, delegates embarked to the far corners of Scandinavia on a choice of four field-trip excursions to mines as far north as Boliden and Kiruna

in Sweden, and east to Otanmaki and Outokumpu in Finland.

Chosen to key-note the conference at the opening meeting was a well-known American of Scandinavian descent, Elmer B. Pehrson, of the U. S. Bureau of Mines' Division of Foreign Activities. Mr. Pehrson pointed up the growing responsibility of the mining and metallurgical professions in meeting the rapidly expanding world-demand for mineral raw materials. As an example of the trend in world metal consumption, he pointed to world copper reserves presently estimated at 225,000,000 metric tons, equivalent to a 70-year supply by previous yardsticks but less than a 10-year supply if other nations of the world begin to approach the United States per capita consumption of 18.7 pounds per annum. Rapid expansion of the annual world requirements of copper and other metals is a certainty, Mr. Pehrson stated, and will tax the abilities of the metallurgist and his

mining colleagues in wresting the needed product from ever lower grades of ore. He decried the lack of understanding of mining and mineral problems by political leaders who, he said, seem to think that constantly increasing supplies of materials can be obtained automatically.

The growing complexity of modern metallurgical practice was clearly demonstrated by the titles and subject matter of papers given at the Stockholm Conference. While perhaps a third of the papers given were considered by many delegates to be of somewhat academic nature in the field of laboratory or basic research, the balance delved deeply into subjects where practical application is already underway.

The main sections of the meeting included exhaustive treatises on comminution; classification and gravity separation; new developments in flotation; magnetic concentration; roasting and sintering; and the rapid advent of

chemical processing into systems of ore beneficitation.

Rock Grinding Top Interest

Subject of perhaps the keenest interest and discussion, both in and out of the convention hall, was the controversial item of "rock-grinding", both wet and dry, and the related subject of grinding at super-critical speeds. The paper by H. Tanner, mining engineer, and T. Heikkinen, engineer of the Outokumpu Company, covering results and reported economies of rock-grinding methods employed at Finland's Outokumpu mine was widely discussed, as was the review by Professor R. T. Hukki of the Finland Institute of Technology on results being obtained in grinding at super-critical speeds. Consensus of delegates primarily concerned with grinding practice is that more work must be done to determine ore-types and conditions favorable to this practice; that too many broad claims are



AMERICAN VISITORS to the International Minerals Dressing Conference held at Stockholm, Sweden in September, included Mr. and Mrs. Park A. Hodges (representing the Mining & Metallurgical Society of America), Behre Dolbear & Co. (left) and Mr. and Mrs. Harlow Hardinge, President, Hardinge Company, Inc. (right).

MINING WORLD photograph



EAST MEETS WEST as Edgar Puffe (left), chairman of Germany's CDMD ore dressing committee, talks to Hidehiko Mino, Mitsui Mining & Smelting Company.

Ge-Be photograph



NEWPORT MINING CORPORATION's Frank McQuiston, Jr. (left) discusses his flotation paper with Ake Schwabe of Sweden's Stora Kopparberg AB.

MINING WORLD photograph



CONGRATULATIONS to Elmer Pehrson (left), U. S. B. M., who was first speaker, from John Hedlund, director of sponsoring group Svenska Gruvföreningen.

Ge-Be photograph



CONVENTION CHAIRMAN G. P. Kihlstedt (left) of Kungl. Tekniska Hogskolan talks about next meeting in London to F. T. Doughty of Ashford, Middlesex.

Ge-Be photograph

MINING WORLD

being made for technique that probably will be practicable and economic for a fairly narrow range of materials. Also pointed out was the fact this subject matter is anything but new, having been worked upon in the United States by Dr. Fahrenwald and others for more than 25 years.

Among outstanding papers at the convention was that presented by Newmont Mining Company's chief metallurgist, Frank W. McQuiston, who accomplished the difficult work of summarizing most of the advances in flotation of complex copper-lead-zinc ores, a paper that contrasted noticeably with some highly theoretical Russian papers dealing essentially with laboratory research. However, the paper on Separation of Bulk Sulphide Concentrates by Flotation, given by the USSR's A. S. Konev and L. S. Debrivnaja, covering some results received in full scale operations, was well regarded and received.

Here is the list of registrants from the United States: Thomas E. Ban, director of research, McDowell Company, Inc.; Roger E. Barthelemy, director of research, Carpeo Research and Engineering Company; J. Bruce Clemmer, U. S. Bureau of Mines; Donald J. Drinkwater, manager Marcy mill division, Mine and Smelter Supply Company; Morris M. Fine, U. S. Bureau of Mines; Albee Flodin, president, Lake Shore Engineering Company; John D. Grothe, director, Dorr-Oliver Inc.; Joseph R. Grouts, chief engineer, Marcy mill division; Harlow Hardinge, president Hardinge Company, Inc.; De Forest H. Hardinge, assistant to president, Hardinge Company; Henry W. Hitzrot, Dorr-Oliver, Inc.; Parke A. Hodges, vice president, Behre Dolbear & Company; Max F. Holsinger, general manager, MINING WORLD-WORLD MINING; Frank W. McQuiston, Jr., chief metallurgist, Newmont Mining Corporation; L. A. Roe, manager, International Minerals and Chemicals Corporation; W. B. Stephenson, president, Allen-Sherman-Hoff Pump Company; Ralph B. Utt, vice president, Western Machinery Company; and Clarence Zeuch, metallurgist, The Dow Chemical Company.

One returning American expressed a thought in which other United States delegates seemed to share the same lurking suspicion: Somewhere along the line in the production rush since Korea, American research and development in certain areas of mining and metallurgy seemingly has lagged. In light of some of the work being conducted in various countries of Europe, Canada, and South Africa, one is prompted to wonder just who is taking what mountain to which Mohammed these days.



KEEN INTEREST is shown by this group of metallurgists at Stockholm technical sessions. Simultaneous, three-language translations were made of every speech—English, French, and German. Listener could select language to hear through earphones.

Ge-Be photograph



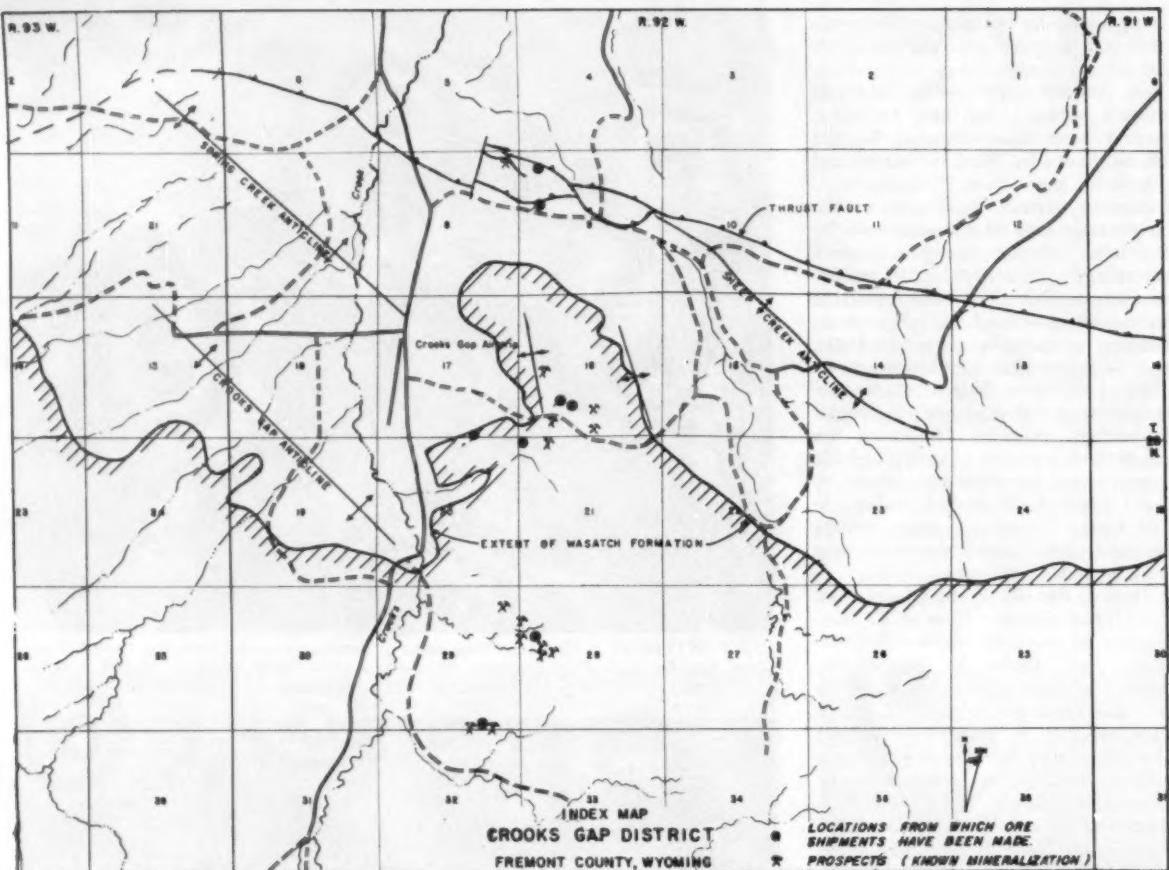
FLOTATION EXPERTS meet at Stockholm, and floatation is what they talked about. At left is Ralph Utt, vice president, Western Machinery Company. Per A. Fahlström (right), chief metallurgist for Boliden Gruv AB, is co-author of article on page 46.

MINING WORLD photograph



URANIUM REVIEW was shared by Bengt Fagerberg, chief engineer, LKAB, Malmberget, Sweden (left); Björn Berglund, engineer for Sweden's AB Atomindustri; and Bruce J. Clemmer, U. S. Bureau of Mines, and winner in 1956 of MINING WORLD Technology Award.

MINING WORLD photograph



Structural Control of Crooks Gap U₃O₈ Gives Clues for Wyoming Prospectors

By CHARLES E. MELBYE

When the Phelps Dodge Corporation exercised its option on Wyoming Uranium Corporation's uranium claims and leases in Crooks Gap, Wyoming, the mining world knew that P-D had found an important reserve of uranium. Under the terms of its option P-D had drilled 100,500 feet of exploration hole, most of it on Section 16 on relatively close centers—50, 100, and 200 feet.

This article analyzes this and other

Mr. Melbye is a partner in the geological and geophysical consulting firm of Melbye and Mervin with offices in Golden, Colorado. The firm was consultant to Phelps Dodge Corporation and Wyoming Uranium Corporation during their Crooks Gap exploration programs. Much of the data was collected during these programs.

exploration in the district to aid those companies or individuals planning drilling programs in the area. It is based on personal experience and observation since the district first became of interest in 1954. As most of the experience gained by the writer has been in a consulting capacity for various firms, specific locations of ore deposit features can seldom be disclosed. However, the general criteria and characteristics of ore deposition are explained in detail.

The Crooks Gap district is located between the Crooks Gap and Sheep oil fields, about eight miles south of Split Rock, Fremont County, Wyoming. Roughly, the area lies midway between Rawlins and Lander and is located about 20 miles south of the important Gas Hills uranium district.

Center of activity lies in T. 28 N.-R. 92 W.

AEC Finds Ore By Drilling

In December 1953 during early Wyoming uranium excitement three claims were staked immediately to the north of Crooks Gap, but the first claims to be staked in the Gap itself were the Sno-Balls, discovered by air scintillation by Bishop and Spurlock, Fremont County surveyors. The staking of the Sno-Ball claims was in early 1954, followed immediately by leasing and staking by Hepburn T. Armstrong of Wyoming Uranium Corporation. Early drilling in 1954 and 1955 was by the U. S. Atomic Energy Commission which drilled about 16 holes on wide spacings covering the Gap proper, an area

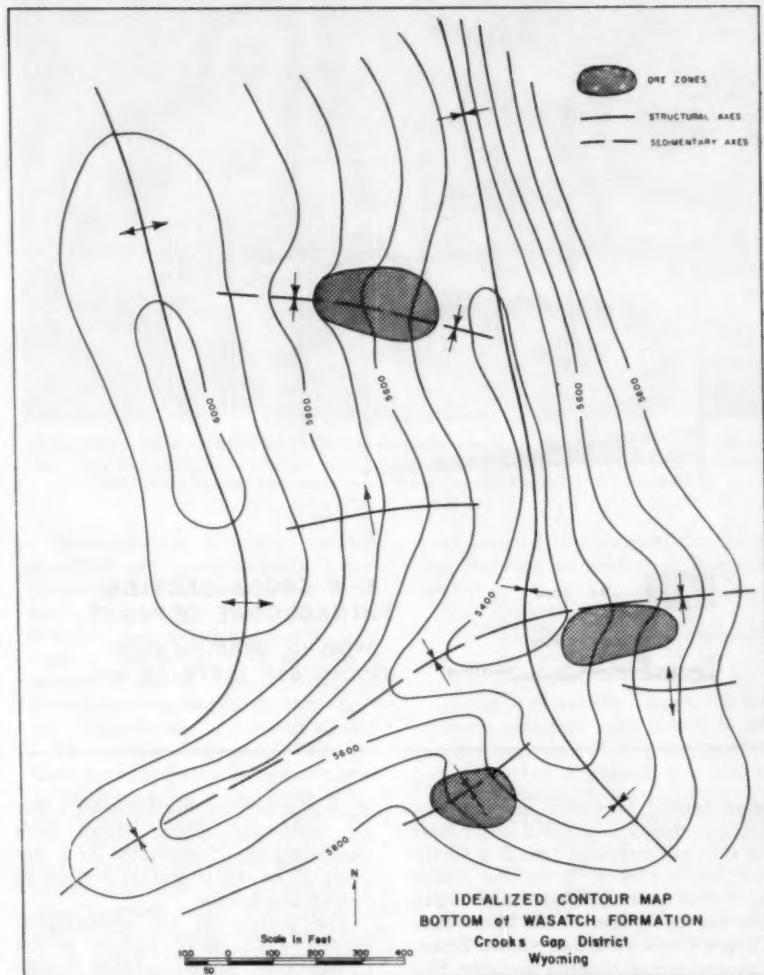
about three miles long and one mile wide; surprisingly, about 12 holes showed commercial grades and thicknesses of uranium. The first mining operation was that on the Sno-Ball claims in Section 29, T. 28 N., R. 92 W. They were formerly owned by the Coke River Development Company and others, but have been owned by Lost Creek Oil and Uranium Company since 1955. With the construction of a mill eight miles north of the Gap by Lost Creek, this company changed its name in March 1957 to Western Nuclear Corporation. Open-pit mining was also done on Wyoming Uranium's Helen May claims, Section 17, in 1955. Trial shipments have also been made from the Wyoming Uranium Ravine, Congo, and Beatrice ore bodies and from the holdings of Gaddis Mining Company, Split Rock Mining Company, and San Juan Uranium Company. Exploration has been most extensive since the fall of 1955 when Wyoming Uranium, Gaddis Mining, Mile High Minerals, and Split Rock-Crooks Gap Mining (Harrower Brothers) all blocked out ore bodies or found promising mineralization. The spring, summer, and fall of 1956 saw exploration drilling reach its peak.

In addition, Western Nuclear completed a major drilling program in the vicinity of its Sno-Ball mine. Most exploration ceased for the winter of 1956 with the exception of continued drilling by Phelps Dodge Corporation on Wyoming Uranium Corporation's Section 16, but increased again with summer weather. Rare Metals Corporation of America drilled a portion of the Gaddis Mining Company property. As of April 10, 1957, Phelps Dodge had completed 92,000 feet by drilling on Wyoming Uranium's property, which has been the most extensive to date, and most of it on Section 16.

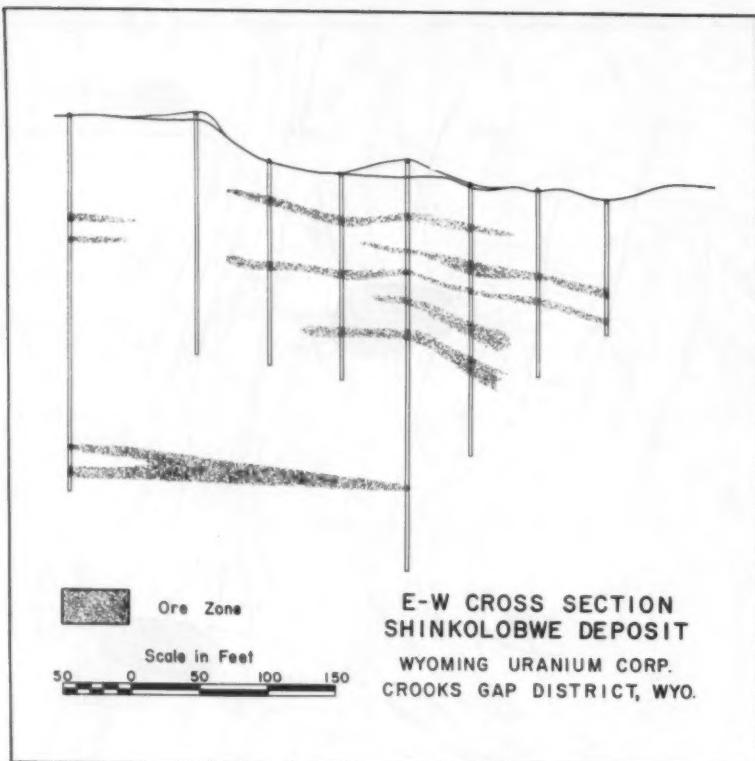
As to the results of the above exploration, Phelps Dodge relinquished its option on the Trey group of claims of Mile High Minerals, but as of June 30, announced the exercising of the option on Wyoming Uranium's holdings. Continental Uranium essentially confirmed the Gaddis Mining Company ore bodies and has already completed some experimental mining. Humphreys Investment Company obtained negative results and terminated operations in December 1956. K. C. Heald (Murchison), Lisbon Uranium, and Sutton terminated their drilling programs in 1956 with unannounced results.

Regional Geology

The regional geological setting is similar to that of the Gas Hills and



FROM THE AIR the north central part of Crooks Gap uranium district looking north. Wyoming Continental's camp shows at right center. The numerous drill-site and ore haulage roads show clearly on this Gaddis Mining Company photograph.



other central Wyoming uranium districts in that it is situated on or near en echelon anticlines trending southeast or northwest from the major northwest-trending Sweetwater Arch. The Gas Hills, Rattlesnake Mountains, Cooper Creek area, and Alcova Reservoir area are all situated similarly. The Crooks Gap district is in close association with the Crooks Gap, Sheep Creek, Spring Creek, and Happy

Springs anticlines. Furthermore, a major northward-dipping thrust fault paralleling the Sweetwater Arch appears to be an important feature in district localization.

The portion of the stratigraphic column which is of interest in the Crooks Gap district is very briefly listed for reference.

Practically all uranium mineralization is found in the Wasatch, which

consists largely of a disorderly series of buff or light tan, coarse-grained sandstones and conglomerates, many of which may be termed arkoses. Occasional buff, red, or gray siltstones are also present. Although bedding may be mapped, continuity of definite lithologic units is almost non-existent, thereby implying a rapid deposition of eroded material from the nearby granite mountains composing the Sweetwater Arch. Erosion, redeposition, and consolidation of the granitic materials has been so rapid that the arkoses often are very similar to a granite in appearance. Many large granite boulders are found throughout the Wasatch.

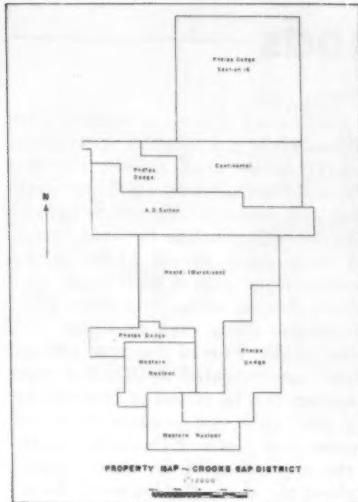
The other formation of interest is the underlying Tertiary (Paleocene) Fort Union siltstones, mainly because its identification is necessary to define the bottom of the Wasatch. Occasional radioactivity of minor importance may be found. Because of similar siltstones in the Wasatch and the presence of a transition zone, often about 50 feet thick, its identification from drill cuttings is difficult. After 10 feet or more of continual silts are drilled, a core should be taken to aid in more positive identification. The Fort Union is rarely arkosic and is variegated green, gray, and red in color. Its identification in outcrops is comparatively simple from the distinctive colors. East of Section 16 towards the Sheep Creek anticline, the Fort Union has been eroded and the Wasatch rests directly on the dark gray to black Cretaceous Cody shale.

Vein deposits along the thrust fault are of minor importance. Briefly, the stratigraphy of importance on the Wyoming Uranium Beatrice claims, Sec. 9, are the black Cody shales upon which have been faulted the red silts and shales of the Triassic Chugwater formation. The Chugwater is distinctive from the resistant crinkly Alcova limestone marker bed near the middle, which is 5 to 10 feet in thickness. On the Mountain Mesa Uranium Company property, also in Section 9, the medium-grained, gray to light brown Cambrian sandstone is faulted against the pre-Cambrian granite. Purple, red, and green shales are also a distinctive feature of the Cambrian, which has not been subdivided in the Crooks Gap district.

Structure: In addition to the regional anticlinal setting, some correlation can be noted with details of structure, as all known deposits either fall on the crests or on flanks of major or minor anticlines. The relationship is, as yet, not completely clear, but structure contour maps prepared on the base of the Wasatch for a small part of the district show a localization of uranium deposits on the flanks of an

CROOKS GAP STRATIGRAPHIC COLUMN

Age	Formation	Generalized Lithology
Tertiary	Wasatch	Buff conglomerate and sandstones w/ occasional siltstones. Gray, green, and red siltstones.
	Fort Union	Gray to black shale. Gray bentonitic sandstone and shale. Siliceous shale. White to buff sandstone. Black shale. Buff sandstone, gray to pink shale.
Cretaceous	Cody	Variegated shale, thin sandstone, marl, limestone. Greenish-gray glauconitic sandstone, red shale, greenish-gray calcareous shale.
	Frontier	Massive, cross-bedded salmon sandstone.
Jurassic	Morrison	Red silt and shale w/gray crinkly limestone in middle.
	Sundance	Light brown sandy shale w/shaly limestone.
Triassic	Nugget	Light gray limestone & dolomite, red and green shale.
	Chugwater	Massive, buff, cross-bedded sandstone.
Permian	Dinwoody	Limestone, sandstone, and vari-colored shale.
	Phosphoria	Gray, massive limestone.
Pennsylvanian	Tensleep	Purple and red shale, gray sandstone and thin limestones.
	Amesden	Yellow-brown granite.
Mississippian	Madison	
Cambrian	sed	
Pre-Cambrian		



PHELPS DODGE CORPORATION's exploration camp on the south side of the Crooks Gap. This picture looks northeast over typical surface terrain with few rock outcrops. First mineralization was found near the camp site by airborne prospecting.

anticline with superimposed synclinal trends at right angles which are believed to be sedimentary channels.

The striking feature of faulting is the northward-dipping thrust fault system which parallels the Sweetwater Arch. This fault has overthrust the Triassic Chugwater formation and the Cambrian formations on the Cretaceous Cody shale, the Cambrian sandstone on the Carboniferous beds and on the pre-Cambrian granite, as well as other complex fault blocks. This faulting has produced the prominent topographic knob known as the "Boer's Tusk," which is an upthrown block of Madison limestone. Faulting in the Wasatch consists of ill-defined normal or tension faults of minor displacements, which are discernible largely with the aid of photographs. With careful field and photo study, some topographic and vegetational expression of these faults may be seen.

Mineralization: Uranium minerals identified are predominantly uranophane, with lesser amounts of uraninite, becquerelite, phosphuranylite, coffinite, and metatyuyamunite. Minerals in the thrust fault deposits of Section 9 are of a slightly different assemblage; uranophane, meta-autunite, autunite, and a uranium silicate¹.

The uranium mineralization is confined to six, and sometimes more, zones as impregnations in the lower part of the Wasatch formation. The control of these zones is difficult to ascertain, as no definite lithologies are predominantly favorable, and projection of a zone between holes, based on lithology, is seldom valid. However, projections along the sedimentary dip are very consistent and often valid for hundreds of feet. Away from the ore-grade portions of a zone, projections can be made quite definitely, based on "kicks" from the probe logs.

A tabulation of data on ore holes

and barren holes suggests the following host rock favorability in decreasing order:

1. Sandstone
2. Silty sandstone or siltstone
3. Conglomerate
4. Shale

Color favorability is no definite criteria although light brown to gray colors are somewhat more predominant than red or greenish-gray mineralized sediments. Medium-grained lithologies are somewhat more favorable. Feldspar content is not important, based on hundreds of microscopic analyses of cuttings by Phelps Dodge. This content is quite consistent from 10 to 30 percent. Carbon content, although not necessarily more abundant in an ore zone, is generally more abundant throughout the portion of the Wasatch containing the uranium deposits. The carbon must represent a

Continued on page 108



PHELPS DODGE's Section 16 ore body underlies the prominent ridge in the background. Note extensive network of drill site access roads. Continental's new Seismic shaft in foreground.



EXPLORATION DRILLING by Rare Metals Corporation of America is underway in area at top right. This view is southeast with new Seismic shaft location in foreground.

Money Making Methods

Man Cars Traveling Inclined Shaft Protected By Floating Safety Dogs

By F. W. SAUERWEIN

Safety devices for the prevention of free fall in event of rope failure have been standard equipment on vertical shaft man cages for many years. Similar protection of inclined shaft man cars, however, has been generally lacking throughout the mining industry.

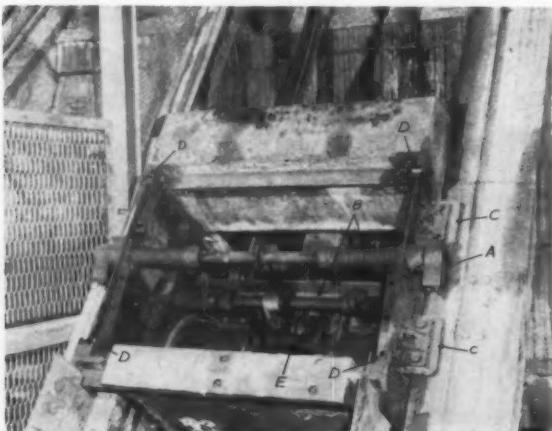
When the New Jersey Zinc Company's Sterling mine decided to install man cars equipped with safety dogs in its new underground slope, its engineering staff could find no published information on an installation of this kind in the industry. As a result the staff turned for aid to a leading manufacturer of mining equipment, and, together, the two forces came up with a suitable mechanism that satisfied full load drop tests.

Sterling mine's underground shaft is an 8- by 18-foot three-compartment, 52° inclined extending 1,045 feet below the 1,850 level. It is lined throughout with 5-inch H-beam sets spaced on 10-foot centers. Most of the shaft is concreted above set tops due to the predominately weak, fractured hanging wall. Shaft track consists of 60-pound rails cushioned with 2-inch treated plank and bolted to short lengths of 5-inch H-beams imbedded in transverse concrete piers which, in turn, are spaced on 10-foot centers. The man car used is the open gondola, stepped type, 24 feet in length and with a capacity of 21 men.

The major obstacle confronting the application of standard spring-actuated, toothed cams or safety dogs to a man car of this type is the potential misalignment of fixed guides and safety dogs resulting from wear of car wheels and track rails. This problem was overcome by mounting the safety dog mechanism in a floating assembly which compensated for such wear by means of springs and guide rollers.

Picture No. 1 shows the entire safety mechanism with cover plate removed, at the top end of a man car. Toothed safety dogs (A) mounted on spring-actuated revolving

Mr. Sauerwein is mine engineer at New Jersey Zinc Company's Sterling mine at Ogdensburg, New Jersey.



PICTURE NO. 1 shows the entire safety mechanisms, with the cover plate removed, at the top end of a man car. Free-fall protection in inclined shafts has been lacking.

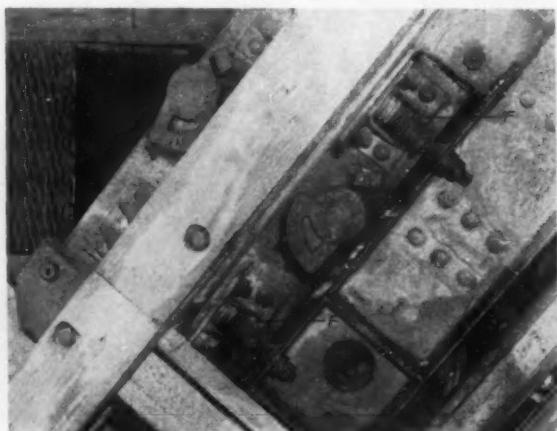
shafts (B), and safety guide shoes (C) are an integral part of the floating assembly which is free to move up or down against the steel rollers (D) on the main chassis. The two shafts are connected by a drive chain and the lower shaft is actuated by the lever arm assembly (E) which is fixed to the main chassis. The remaining linkage to the drawbar, and the drawbar and compression spring assembly are similar to standard equipment on vertical shaft cages.

Picture No. 2 provides a close-up of the side of the floating mechanism and shows the safety dogs on upper and lower face of the timber guide. Two of the four springs on which the unit "floats" are indicated at (F). The supporting base of these springs can be raised or lowered by means of the adjusting nuts. In actual practice these are adjusted so that the upper wear plates of the safety guide shoes just barely ride the upper face of the timber guide at its high spots throughout the shaft. Guides are 5- by 6-inch, pressure treated yellow pine bolted to 6-inch channels fastened between shaft set legs to prevent sagging. Great care was taken in installing guides in order to keep variation in height of timbers above shaft track at a minimum.

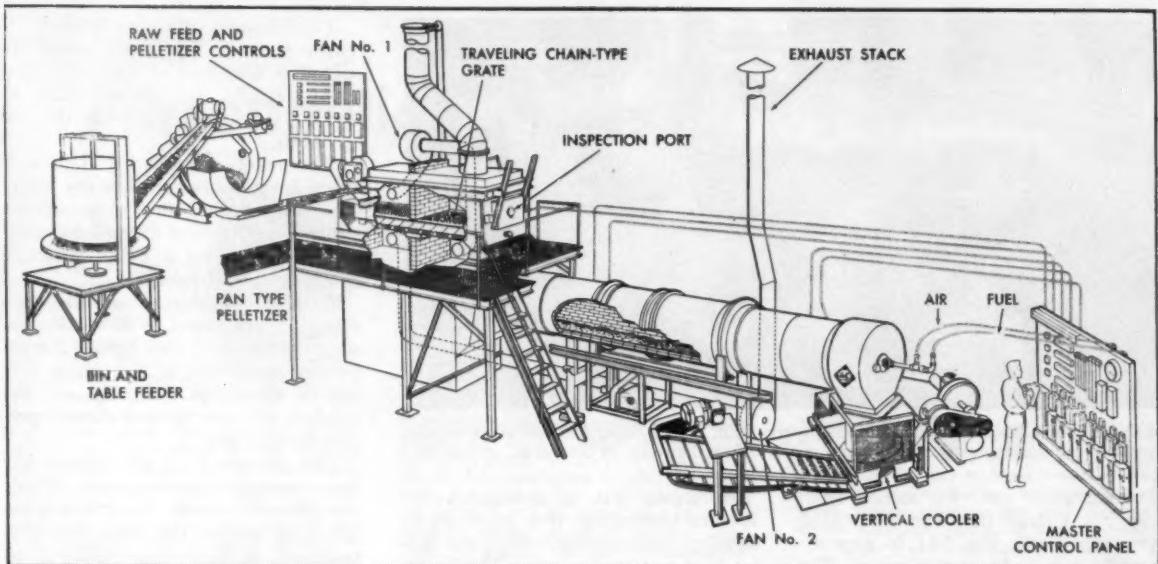
In preliminary trial runs of the man car and before any drop tests were made, a somewhat unexpected problem developed in the operation of the safety mechanism. It was found that man car oscillations caused by uneven braking when lowering out of balance very often actuated the safety dogs, hanging up the car, and creating a hazardous situation. This condition was eliminated by the addition of two hydraulic checking cylinders between the drawbar and bail of the man car. The action of these units momentarily dampens or checks the retraction of the drawbar in normal operation but does not appreciably delay proper functioning of the safety dogs in case of rope failure.

After the above units were installed and a few minor adjustments were made, a full load drop test was performed which indicated the efficiency of the device by stopping and holding the man car after a total movement of 4-inches.

At the present time this safety mechanism has been incorporated in the design of new man cars which double the capacity of the previous ones for Sterling mine's main shaft.



PICTURE NO. 2 provides a close-up of the side of the floating mechanism and shows the safety dogs on the upper and lower face of the timber guide.



GRATE AND KILN process for pelletizing and heat hardening of magnetite concentrate developed by Allis-Chalmers Manufacturing Company.

facturing Company. Diagram shows equipment and its location at the company's pilot plant at Carrollville, Wisconsin.

New Pellet Hardening Method Uses Grate and Kiln Firing

By W. F. STOWASSER, JR.

A new process for pelletizing and heat treating magnetite concentrates to form extremely hard, durable pellets for blast furnaces has been developed and pilot plant tested by Allis-Chalmers Manufacturing Company.

Essentially, the process consists of four steps: (1) forming the pellets in a balling pan or drum, (2) drying the pellets on a moving grate, (3) heating (partially oxidizing) the pellets on a moving grate, and (4) final burning of the pellets in a short rotary kiln.

The objective of the new grate and kiln process is to convert pelletized magnetite concentrate by heating with controlled temperatures to economically produce a hard durable product.

The first step is to produce a pelletized feed from magnetite concentrate. The concentrate must be ground to that fineness required for the production of a stable green pellet. Pellet

sizes of from $\frac{1}{8}$ to $\frac{1}{4}$ -inch in diameter have been tested with this process and can be produced by conventional balling drum or balling pan procedures.

Preheating On Grates

The green magnetite pellets, containing 0.5 percent bentonite, are fed to a travelling grate. This grate area is divided to provide two zones. The first zone is used for drying and the second zone is used for preheating. Each grate zone incorporates its respective furnace and windbox.

The grate continues moving the pellets to the pre-heat chamber, where a downdraft of hot (1,750 to 1,850° F) highly oxidizing gases from the rotary kiln initiate the conversion from magnetite to hematite.

During this oxidation reaction, individual grains of transformed hematite bridge together by grain growth and recrystallization in a solid state to start formation of a mineral structure within the pellet. This transformation ($4\text{Fe}_3\text{O}_4 + \text{O}_2 \rightarrow 6\text{Fe}_2\text{O}_3$) develops sufficient crushing strength (100 to 200 pounds) to withstand the tumbling action of the kiln. Bridging be-

tween the individual pellets does not occur because of the small area of surface contact.

Firing In Kiln

Pellets, after drying and preheating on the grate, are stripped from the grate and are fed to a rotary kiln. The function of the kiln is to raise the temperature of the pellets to the optimum firing temperature for pellet hardness and strength, accomplish uniform heating of the kiln charge, and provide a combustion chamber for burning fuel for the process.

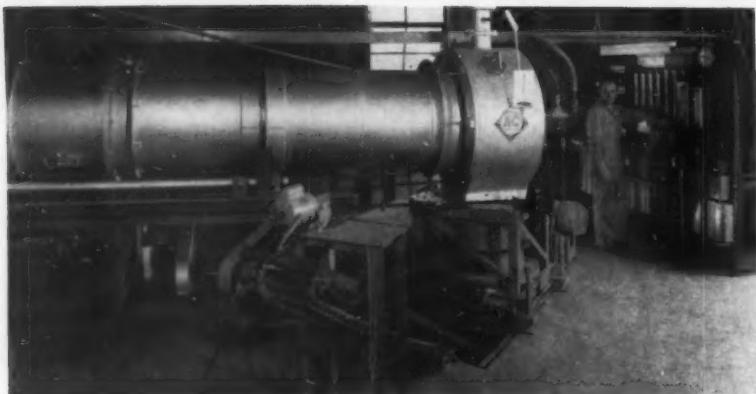
Pellets discharged from the kiln are fed to a vertical rotary shaft cooler. Pellets are cooled to complete the processing.

Fuel for the process is supplied by the kiln burner. Although any conventional solid, liquid, or gas fuel can be used for firing the kiln, for convenience, propane gas is used in the pilot operation. Process heat is also obtained by efficiently recovering the sensible heat from the kiln product in the cooler. Hot secondary combustion air, recovered by cooling pellets from above 2,000° F. to about 350° F. or lower, effectively reduces the primary air and fuel requirements.

The rotary kiln raises the temperature of the kiln charge to a range of temperature from 2,350 to 2,450° F.

The temperatures of the exhaust gases from the kiln range from 1,750 to 1,850° F. The exhaust gases pass downdraft through the six- to seven-inch-deep bed of pellets in the pre-

Mr. Stowasser is an engineer for the Processing Machinery Department of Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.



FINAL HARDENING is done in this rotary kiln. Initial firing is done on a moving grate. Fired pellets drop vertically into cooler below the right, or discharge, end of kiln.

heating grate zone by suction from the No. 1 draft fan. The differential pressure across the bed is approximately two inches water gauge. The temperatures of the gases after the first pass through the grate, range from 600 to 700° F. The No. 1 fan delivers this air to the drying furnace. Pellets are dried with downdraft flow of gases and these gases are exhausted by the No. 2 draft fan at a temperature of from 250 to 300° F. The suction in the drying windbox is about two inches water gauge.

Why Two Units

From a process viewpoint, the grate performs several functions. Low strength pellets are maintained at

"rest" on the grate to accomplish drying and preheating. It is necessary to develop pellet strength while the pellet is at rest on the grate. This is accomplished in the preheating zone by subjecting the pellets to a flow of highly oxidizing gases at the temperatures noted.

These conditions will initiate the transformation of magnetite to hematite within the pellet and, by the process of grain growth and recrystallization, initiate the development of the mineral structure, hematite, in each pellet. The pellet, subjected to these conditions and reactions on the grate, will develop sufficient strength and durability to be placed in "motion" in the rotary kiln.

Furthermore, the double flow of gases through the grate results in effective filtration of exhaust gases from the kiln and efficient heat exchange from the hot gases to the bed of solids.

The pellets are raised to their optimum firing temperature in the rotary kiln and, during this stage of the process, oxidation of the pellet is completed developing a pellet structure of a network of hematite.

If the temperature of the kiln charge is not raised to cause thermal decomposition of the formed hematite to magnetite, a slag phase will not be formed in the pellet and the product will contain less than 1 percent ferrous iron.

The product from this process has been tested in a standard ASTM, two-lifter bar drum, for 200 revolutions. Because of the controlled heat treatment of the process, pellets subjected to this test are not caused to fracture or break, but do produce fines from surface abrasion. Test results show that a range of from 1 to 5 percent of dust will be generated from this hardness test and this percent of dust may be expressed as the same percent passing 6, 10, or 28 mesh.

The fuel consumption required for this process, determined by pilot plant tests, will range from 700,000 to 800,000 Btu per net ton of product. The choice of fuel will be that which is most economical for a particular installation and location.

The bulk weight of the product will be approximately the same as the bulk weight of the green pellets fed to the process and ranges from 125 to 140 pounds per cubic foot.

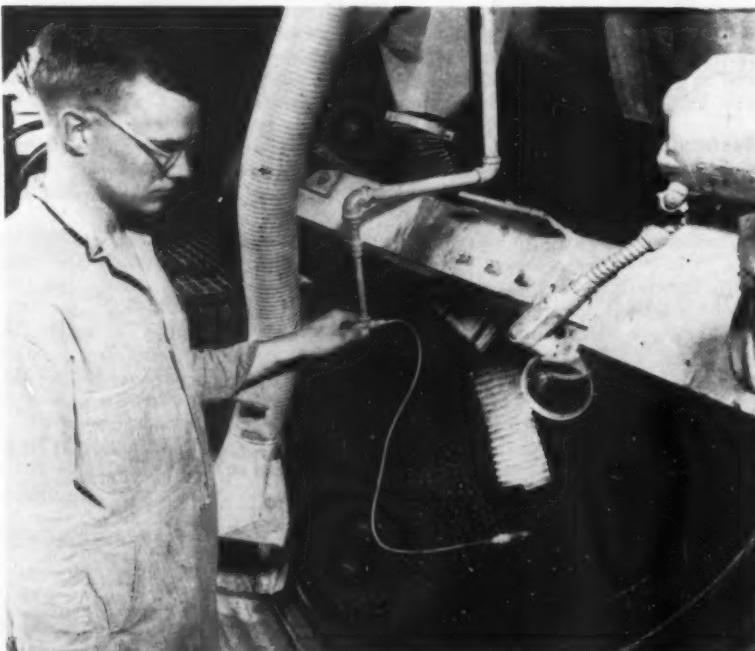
The production rates obtained from the pilot operation range from 2.75 to 3.0 net tons of product per square foot of grate area per day.

Research, Pilot Testing

Following preliminary research work, pilot operations to test and evaluate the new process were carried out at Allis-Chalmers pilot plant facilities at Carrollville, Wisconsin. Here engineers duplicated all stages of the pelletizing and burning multiple ton sample batches of magnetite concentrates from many different sources.

Pilot plant facilities are available for customer tests and work on ores from different mining operations. Research and development on modifications for heat treating hematite concentrate are going forward. Allis-Chalmers engineers are confident that a suitable process will be developed for this other important type of iron ore.

THE END



PELLETIZING the finely ground concentrate is the first step in the new four part process. This pan type pelletizing plate forms uniform sized pellets which discharge onto conveyor belt. Operator adjusts water spray in picture.

United States

Personalities in the News—

ROYCE A. HARDY, Jr. was recently appointed to the office of Assistant Secretary of the Interior for Mineral Resources, succeeding **FELIX E. WORMSER** who resigned in June. Mr. Hardy was formerly general manager of Manganese Incorporated of Henderson, Nevada, serving in that capacity since 1956. Prior to that time he was general superintendent of the Getchell mine in Humboldt County, Nevada. As Assistant Secretary for Mineral Resources, Mr. Hardy will supervise the programs of the Bureau of Mines, the Geological Survey, Office of Oil and Gas, the Defense Minerals Exploration Administration, Office of Minerals Mobilization, and the Division of Geography.



Allen E. Jones, manager of the U. S. Atomic Energy Commission's Grand Junction, Colorado operations office, toured the Gas Hills and Crooks Gap uranium mining areas recently. He was accompanied by C. E. Tonry, director of the concentrate procurement division at Grand Junction, and E. W. Grutt, chief of the sub-office in Casper.

James Warner is now assistant superintendent of the Pioneer underground mine of Oliver Iron Mining Division at Ely, Minnesota.

Philip L. Jones, consulting mining engineer, has been appointed director and consultant to the mining and metallurgical division of the Bruce Williams Laboratories at Joplin, Missouri. Mr. Jones will continue to maintain his own office in Joplin.

Walter Dean recently resigned his position with the Southwest Potash Company in Carlsbad, New Mexico to take charge of United States Metals Refining Company's shaft-sinking project at Wakefield, Michigan.

Scott L. Burrill has been promoted to concentrator general foreman of the Nevada Mines Division of Kennecott Copper Corporation at McGill, Nevada. Mr. Burrill, who has been employed at the Nevada Mines Division since 1950, was formerly concentrator general shift foreman.

Donald W. Lindgren is now chief mining geologist for Northern Pacific Railway Company with headquarters in St. Paul, Minnesota. Mr. Lindgren's new duties include supervision of exploration and development of the company's mineral resources other than oil and gas. **Virgil W. Carmichael** has been appointed mining engineer for the company's Geology Division and will be responsible for administration and inspection of coal properties from St. Paul to Seattle, Washington.

Kelvin Sproule has been transferred to the International Nickel Company's New York office to take part in investigations of the use of atomic energy effects in research. Mr. Sproule was

formerly consulting metallurgist on the staff of International Nickel Company of Canada, Ltd., at Copper Cliff, Ontario.

A. J. Carlson, chief chemist at Climax Molybdenum Company's mill department at Climax, Colorado, has resigned to accept a position as chief chemist for the Erie Mining Company at Hoyt Lakes, Minnesota.

Benton Boyd will succeed A. G. Kirkland as manager of United States Smelting, Refining and Mining Company's U. S. and Lark mine in the Lark-Bingham district of Utah. **Max M. DuBois**, assistant to Mr. Kirkland, will now serve as assistant to the vice president. Mr. Boyd was formerly general superintendent of the mine. Mr. Kirkland, former manager of Western Mines, has resigned.

Myron O. Carlson will replace Esler R. Bechtel, Jr. as chief chemist for the Canisteo District of Oliver Iron Mining Division, U. S. Steel Corporation. Mr. Bechtel resigned his position to join Utah Construction Company in their Marcona Mining operations in Peru.

Malcolm Ian Ritchie formerly associated with the Rio Tinto Mining and Development Company in the Blind River uranium fields of Canada, is now mill superintendent for Lucky Mc Uranium Corporation in Wyoming. Construction is underway on the Lucky Mc Uranium mill in the Gas Hills district.

Charles E. Prior was recently named mining director and elected to the board of Western Gold & Uranium, Incorporated with headquarters in Leeds, Utah. Mr. Prior has been a consulting engineer for Western and other mining firms since early 1956, and prior to that served with the American Smelting and Refining Company. Re-elected to the board of directors were: Ralph G. Brown, president; David P. Shirra, vice president and treasurer; Edward Bierma, general counsel; Beren Backus, secretary;



Officials of Lucky Friday Silver-Lead Mines examine high-grade silver-lead ore on display at the company's third annual employees' barbecue held recently near Mullan, Idaho. From left to right are: CHARLES E. HORNING, Lucky Friday president; JOHN A. FEATHERSTONE, company general manager; JOSEPH T. ROY, manager of American Smelting & Refining Company's East Helena, Montana plant; S. M. LANE, plant superintendent; E. A. HASE, assistant plant superintendent; L. F. CLOW, plant engineer; and C. G. DE GOOYER, plant chief accountant.

SCOTT TURNER, mining engineer, has been chosen to receive the Hoover Medal for 1957, sponsored by the American Institute of Mining, Metallurgical and Petroleum Engineers and three other engineering organizations and awarded for distinguished public service. Mr. Turner's career in mining began in Tombstone, Arizona and has carried him to many countries throughout the world. He is a former director of the United States Bureau of Mines and past president of the American Institute of Mining, Metallurgical and Petroleum Engineers.



Richard W. Ince and **Robert W. Bull, Jr.**

Recent promotions at Kennecott Copper Corporation's Utah Mines Division include: W. P. Carder promoted from grinding and flotation foreman to general mill foreman; L. H. Fisher, former crushing foreman will replace Mr. Carder; R. D. Higley promoted to general mill foreman; R. E. Peterson promoted from flotation shift boss to crushing foreman; M. Boyd Llewellyn from casting shift boss to casting foreman; Elmer C. Speers from general mill foreman to design, engineer; and John C. Larsen from general mill foreman to assistant tankhouse general foreman.

Albert Adams was recently advanced from metallurgical engineering supervisor to supervisor of metallurgical development at International Minerals & Chemical Corporation's Potash Division at Carlsbad, New Mexico. **Alfred Nylander** was also promoted from chemical engineering supervisor to supervisor of chemical development.

Dr. Henry D. Smyth, administrator of research programs concerning atomic and hydrogen reactions as sources of useful power, will be the guest speaker at the American Nuclear Society meeting in New York City. The subject of the talk has not yet been determined, but will deal with national progress in the nuclear power field.

Merle H. Guise has returned to San Marino, California after a five-month trip throughout Mexico.

E. W. Geist has been appointed general superintendent of open-pit mines in the Michigan Iron River district for the M. A. Hanna Company. Mr. Geist, former metallurgist consultant at the Hanna nickel smelter at Riddle, Oregon, will make his headquarters at the Groveland mine. **F. E. Lee** has been named superintendent of the Groveland property. Mr. Lee was formerly superintendent of Ozark Ore Company's Iron Mountain mine in Missouri.

Benjamin Fridge, chemical engineer, has joined the staff of Menlo Research Laboratory as director of Engineering. Mr. Fridge served as super-

intendent of manufacturing at the Tetraethyl Lead Plant of the Ethyl Corporation at Baton Rouge, Louisiana before coming to San Jose, California in 1950.

Paul E. McDaniel has been named chairman of the board of directors of Ambrosia Minerals, Inc. in Phoenix, Arizona. Mr. McDaniel is also president of Brazos Engineering Company. General manager John V. Persons is the newly elected president of the corporation. Mr. Persons was formerly president of Choy Drilling Company, Houston, Texas and general manager of the Frank Waters Oil Company. George A. Mellen, former president and director, has resigned. Clifford E. Whitehead, vice president and director, has also announced his resignation for reasons of health. He will be replaced by Robert K. White,

vice president in charge of the oil and gas division.

Dr. Richard M. Foose has accepted the position of head of the newly formed Earth Sciences Department of Stanford Research Institute's Physical Sciences Division. The new department will undertake investigations in the fields of mineral deposits, mineral economics and geochemical processes involved in formation of various minerals. Dr. Foose was formerly chairman of the Geology Department of Franklin and Marshall College at Lancaster, Pennsylvania.

W. D. Nebeker, Jr. has resigned his position as chairman of the board of Federal Uranium Corporation, to devote more time to management of Croft Oil Company and Swactika Copper Company, both in Utah. Mr. Nebeker served as board chairman

since the corporation was formed in 1955 and was head of the Kentucky-Utah Mining prior to its merger with Federal.

H. R. Cooke, Jr., mining geologist with Martin Sykes & Associates, C. A. in Caracas, Venezuela has returned to the United States and is now living in Reno, Nevada.

Herbert E. Dunham will assume duties as general smelter foreman of the new smelter now under construction by Kennecott Copper Company at Ray Mine Division operations at Hayden, Arizona. Mr. Dunham was smelter foreman with the Kennecott subsidiary, Braden Copper Company, from 1946 to 1954. He joined the staff of Kennecott in 1957.

Donald E. Macknight was awarded the Mary W. Young Westervelt Fund Loan for one year beginning in September. The grant is one of 16 awards presented each year by the Women's Auxiliary of the American Institute of Mining, Metallurgical, and Petroleum Engineers. Mr. Macknight is a senior metallurgical engineering student at Montana School of Mines, Butte.

Reed F. Welch, ore buyer for the American Smelting and Refining Company, recently spent two months in the Philippines studying the potentiality of the new copper mines.

Norman H. Sherman is the new plant foreman at the Sherman crushing and screening plant of United States Steel Corporation's Oliver Iron Mining Division, Chisholm, Minnesota.

E. R. Jackson will succeed retiring W. A. Kangas as assistant chief engineer of the M. A. Hanna Company in Crosby, Minnesota. Mr. Jackson will transfer from engineering offices on the Mesabi iron range.

Obituaries

F. V. Richard, manager of the Western Mining Department of American Smelting & Refining Company, died recently in Salt Lake City, Utah. Mr. Richard served with the company for 24 years, and was appointed Western Mining manager in 1953.

Bong Ik Ahn, president of the Korea Tungsten Mining Company, died in Korea recently.

J. D. Murphy, assistant secretary of the Anaconda Company at Butte, Montana, died recently. Mr. Murphy began his career with Anaconda in 1905, and in 1940 was appointed assistant secretary of the company.

Frank M. Rothrock, 86, died recently in Spokane, Washington. Mr. Rothrock was a partner in Hercules mine and a member of the board and vice president of Day Mines, Inc. at Wallace, Idaho for many years.

Mark D. Fowler, 64, superintendent of Cia. Minera Asarco, S. A.'s operations at Parral, Chihuahua, Mexico, died there recently.

Joseph M. Johnson, 53, died recently following a brief illness. He was assistant general superintendent of United States Steel Corporation's Oliver Iron Mining Division in Virginia, Minnesota. Mr. Johnson served with Oliver since 1928, in the capacity of chief mining engineer, assistant superintendent, superintendent, and was promoted to assistant general district superintendent in 1952.

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Newsmakers

in International Mining

JOHN METZ has accepted a position as general manager of Amalgamated Rare Earth Mines, Ltd. with headquarters in Toronto, Canada. Mr. Metz was previously manager of the Gaspe Copper Mines; assistant general manager of Tsumeb Corporation in South West Africa, and general manager of Malartic Gold Fields, Ltd. in Halet, Quebec, Canada.



B. C. Roy, assistant chief of the Indian Geological Survey, spent four months in the United States and Canada recently, on a tour of inspection of modern mining methods. Included in his tour were Bunker Hill Company's operations at Kellogg, Idaho and other mining operations in the Coeur d'Alene district, as well as Climax Molybdenum Company's operations at Golden, Colorado.

E. Jacobson, D. J. Farquharson, and H. Alman have been appointed to the Board of Directors of the South West Graphite Company, Ltd. in South West Africa.

A Hungarian mining student, now known only as Dezsee, to protect his family in Hungary, who took part in last fall's Hungarian revolution, is now enrolled at the Colorado School of Mines in Golden, Colorado. Dezsee was a student at the Technical University of Mining Engineering in Sopron, where the revolution broke out last October.

Dr. J. C. Nixon has resigned his position as manager of the Anzin Development Laboratory at Avonmouth, England and is now employed with Consolidated Zinc Pty., Ltd. in Melbourne, Australia.

David W. Schafer, former geologist with the Philex Mining Corporation in Manila, The Philippines, arrived in the United States recently to attend the University of Arizona at Tucson, Arizona.

M. W. Lallman, former senior engineer at the Kaiser Aluminum & Chemical Corporation in Oakland, California, has been transferred to the Kaiser Bauxite Company in Jamaica, where he will serve as assistant to the works manager.

Hans Jorgen Hansen is now employed as mining engineer with Rana Gruber A/S in Mo i Rana, Norway.

New appointments to the executive committee of the Iron and Steel Producers Association of South Africa are as follows: Dr. C. M. Kruger, chairman; C. L. Cartwright, vice chairman, and T. Hirsch, I. F. Scott, and C. W. Sharp.

E. Oppenheimer and G. V. Richdale have been appointed directors of Central Mining and Investment Corporation, Ltd. in Johannesburg, Union of South Africa and of the Corporation's subsidiary, Central Mining Finance, Ltd.

C. G. Rice, executive vice president of the United States Smelting, Refining & Mining Company, toured mining operations at Nome and Fairbanks, Alaska recently. Inspection of the facilities at Chicken and Hogatza, the site of the Koyukuk county operation, was included in his trip.

E. M. Brothers will succeed the late C. Newby as chairman of the board of Clydesdale Collieries Ltd. at New Clydesdale, Transvaal, Union of South Africa.

Marangin Simatupang and Ahari Warga-Dalem exchange mining students from Indonesia, visited mining operations of the Potash Company of America at Carlsbad, New Mexico and Kennecott Copper Corporation's Ray Mine Division at Ray, Arizona. The students are touring United States mining properties under the sponsorship of the U. S. Bureau of Mines.

J. W. Gadberry, general superintendent of services, Braden Copper Company, Chile, South America recently visited Kennecott Copper Company's leach-precipitation-flotation plant at Hayden, Arizona to observe the sponge iron and acid plant and construction of the new smelter.

E. B. Gillanders, vice president of the Rio Tinto Mining Company of Canada, Ltd. will take over the managing directorship of the subsidiary Rio Tinto Management Services, Ltd., succeeding R. W. Wright who assumes the position of vice president. Another Rio Tinto staff change is the appointment of R. C. Hart, former mine manager of Algoma Uranium Mines' Nordic and Quirke properties, as district manager for Rio Tinto Management Services at Elliot Lake. New managing director of the Algoma Uranium Mines is H. E. Nelems, who is also managing director of Milliken Lake Uranium Mines. M. A. Airth has been appointed mine manager at Nordic, and G. L. Hatherly is now manager of Quirke. R. D. Lord will take over managing directorship of Pronto Uranium Mines Ltd. and Rix Athabasca Uranium Mines Ltd, the position formerly held by Mr. Nelems.



KEE YOUNG CHANG (left) has been elected to succeed the late Bong Ik Ahn as president of the Korea Tungsten Mining Company. Mr. Chang, a graduate of Indiana University, Bloomington, Indiana, is considered a prominent leader in the Korean business circle. **SANG KU LEE** was elected to fill the newly created office of vice president of the company. Mr. Lee is also manager of the company's Sang Dong tungsten mine in Korea.

ALLEN H. ENGELHARDT, former vice president and manager of Cerro de Pasco Corporation's operation in Peru, has been promoted to vice president in charge of South American operations with headquarters in New York. Mr. Engelhardt joined the Cerro de Pasco Corporation in January 1951 as assistant manager of operations in Peru and became manager of operations in September of the same year. He will be succeeded at Oroya, Peru by **WILLIS HIGGS**, assistant manager of operations since October 1955.



Oscar Weiss is the new director and deputy-chairman of the Rio Tinto Mining Company of South America Ltd. and a director of the Palabora Mining Company, Ltd. which has been formed by Newmont Mining Corporation, New York, Rio Tinto, and the Merensky Trust to prospect the copper deposit at Phalaborwa in the Northeastern Transvaal.

Paul F. Karrow will join the geological staff of the Ontario Department of Mines, replacing A. K. Watt who has been transferred to the newly formed Water Sources Commission.

Dr. J. W. Whitaker has been appointed as director of the Central Mining Research Station, Dhanbad. Dr. Whitaker was formerly director of the Central Fuel Research Institute.

G. S. Marwah, regional inspector of mines of the Department of Mines, Government of India, has been appointed assistant planning director of the same institution.

Dr. M. S. Krishnan, former director of the Geological Survey of India has been appointed the first director of the Indian School of Mines & Applied Geology, Dhanbad, India.

Mr. K. V. Subrahmanyam is the new professor and head of the Department of Mining at the Indian Institute of Science, Kharagpur, India. Mr. Subrahmanyam is the officiating director of Practical Training at the Indian School of Mines, Dhanbad, India.

J. S. D. Tory and **F. V. C. Hewett**, of McIntyre Porcupine Mines, Ltd., were recently elected to key positions in the Ventures, Ltd., holding company. Mr. Tory, who is board chairman of McIntyre, assumed the same position in Ventures, replacing Thayer Lindsley. Mr. Hewett, president and chief executive officer of McIntyre, took over the same jobs with Ventures, replacing Robert B. Anderson. Mr. Anderson has been confirmed as United States Secretary of the Treasury.

P. K. Roy, inspector in the Department of Mines, Government of India, has been appointed as professor of mining in the Bengal Engineering College, Calcutta. Mr. Roy is presently working in Sitarampur.

Over-specialized equipment hiking costs?

READ HOW ANACONDA handles all material fast with Michigan Tractor Shovels

Most ore mined by the world-famed Anaconda Company at Butte, Montana, is smelted by the Anaconda Reduction Works in nearby Anaconda. From a pioneer beginning, nearly 75 years ago, this smelter has grown to be one of the largest in the world. This growth reflects Anaconda's unceasing search for a better way at lower cost in less time. Typical was their recent shift from slow single-purpose handling equipment to two highly mobile Michigan Tractor Shovels.



**Transports material
weighing 5,400 lbs per cu yd**

These rugged versatile 2½ yard Model 175A's "run" at 27 mph speeds all around the big plant to handle a wide variety of loading tasks. Hard-to-handle chunks of ferro-manganese—*weighing 200 pounds per cubic foot*—are the heaviest tractor-shovel work on hand.

One of the Michigans usually does the entire job. In a few hours it moves weekly requirements of 100 tons 750 feet from plant stockpile to massive timber storage platform. Planetary wheel drive axles, torque converter take up shocks of this rugged work.



**Outworks a crane—
with half the manpower**

Planetary axles and the efficient all-Clark power train help out on another tough job—truck-loading "purification cake"—a sludge from the smelting process, rich in metals such as gold and silver. With a crane, it used to take 12 hours (and a 2-man crew) to load 240 tons; one Michigan now does the same job in six hours—with only one man! Operators like the fast reverse and power-shifting of the Michigan . . . management is pleased with the time and labor saved.



**Goes in to load where
trucks don't dare**

Millions of cubic feet of calcine—iron oxide powder—are stockpiled here; it's used to make sponge iron for

treating copper ore in the flotation process. But on the ground it's a mountain of soft, treacherous dust. Trucks sink deep into the soft footing, so the big-tire four-wheel-drive Michigans go in alone, rush heaping buckets back out. A single Michigan keeps three five-yard trucks busy on a half-mile haul, heaps up to 80 truck loads in a day!



In 8 hours, digs 80 foot trench through rocky soil

Despite busy schedules moving various stockpiled materials, the Michigans find time to do lots of odd jobs, too. Here, a Michigan digs its way through sun-baked earth and rock, excavating the trench for a concrete tunnel to hold electrical conduit. The trench is eight feet deep, ten feet wide, 80 feet long. How long did it take? *Only one 8-hour day*—and this includes piling waste material 100 feet away! The secret is a *full bucket* loaded and delivered every pass, a "trademark" of all Michigans. Unexcelled breakout force, low-level-tipback and low-level-carry also help deliver those bigger loads.



Spots and loads 12 rail cars in 5 hours

Anaconda's two Michigan 175A's spend roughly 30% of their time loading stockpiled crushed limestone. They move empty rail cars into position at the quarry, then fill them up. Loads run about 60 tons per car; each Michigan can fill a dozen cars in only five hours! Off-time jobs include stripping dirt; cleaning haul roads and around conveyors; helping trucks up steep grades; and removing tons of ash from the flue of the smelter stack.

Which of these will fill the bill for you?

Model 12B:

6, 10, 16 (std), 20 or 27 cubic foot buckets

Models 75A, 75B, 75R:

$\frac{3}{4}$, $1\frac{1}{4}$ (std), or $1\frac{1}{2}$ yard buckets

Model 125A:

2 (std), or $2\frac{3}{4}$ yard buckets

Model 175A:

$1\frac{1}{2}$, 2, $2\frac{3}{4}$ (std), 3 or 5 yard buckets

Model 275A:

4 yard (std) bucket

Model 375A:

6 yard (std) bucket

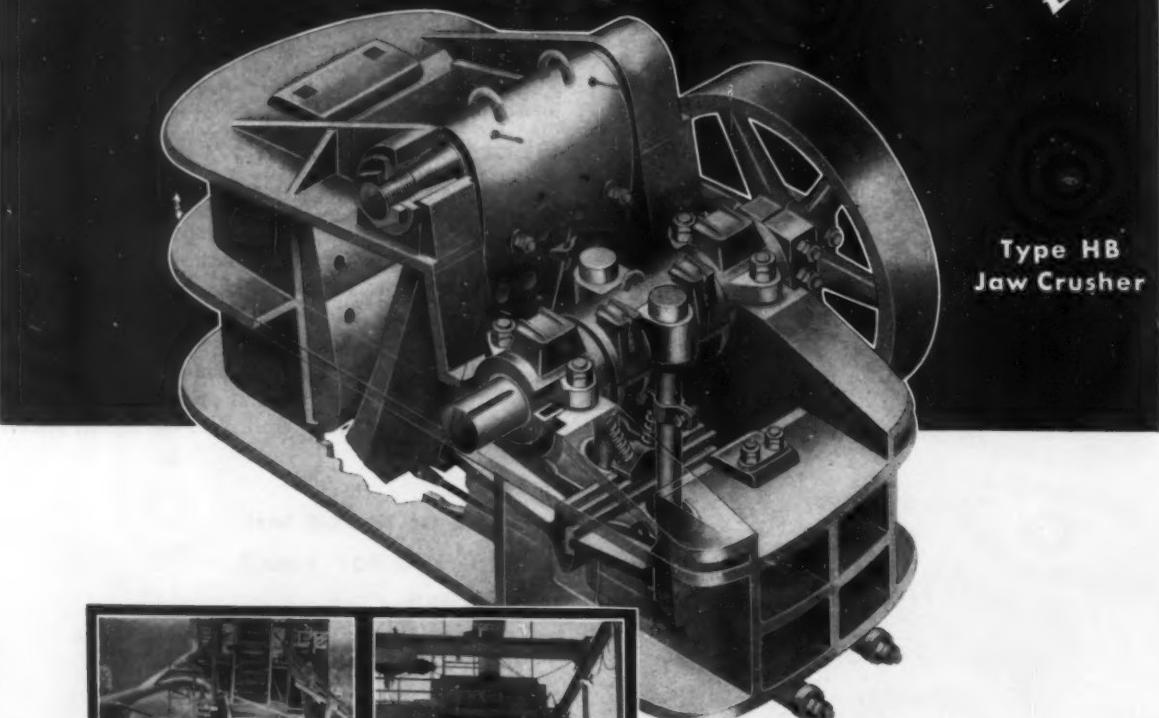
For help in determining which of these eight models and how many of their 37 different buckets and attachments, will do an Anaconda-class job for you, let one of our Job Study Engineers study your layout. A card or a call will bring him. No obligation, of course—but we believe you'll find his suggestions worth further study!

Michigan is a registered trade-mark of

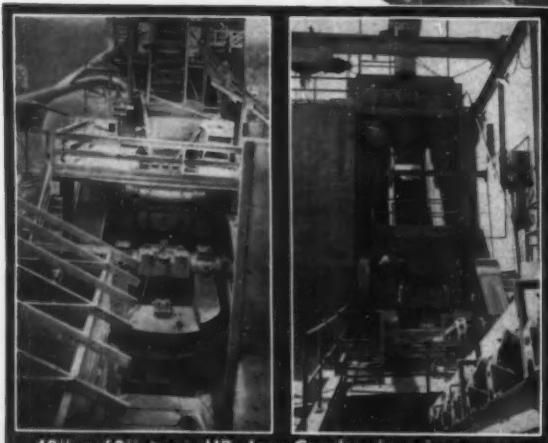
**CLARK®
EQUIPMENT**
CLARK EQUIPMENT COMPANY
Construction Machinery Division
2493 Pipestone Road
Benton Harbor 15, Michigan

TRAYLOR-MADE

is engineering craftsmanship



Type HB
Jaw Crusher



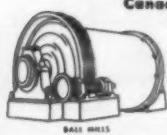
48" x 60" type HB Jaw Crusher in primary service, reducing quarry material to desired size.

Cutaway view of the type HB Jaw Crusher shows the advance design characteristics of Traylor-Made Jaw Crushers—notice the sturdy bulldog pitman. One of the many important features of this crusher is the Traylor curved jaw plate. This design employs the principle of the famous curved fittings which have proved so successful and satisfactory in Traylor crushing machinery. Write for Bulletin #5105 for information.

TRAYLOR ENGINEERING & MFG. CO. 1912 MILL ST., ALLENTOWN, PA.

Sales Offices: New York — Chicago — San Francisco

Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.



BALL MILLS



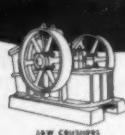
ROTARY KILNS



ARBOR FEEDERS



PRIMARY GYRATORY CRUSHERS



JAW CRUSHERS



SECONDARY GYRATORY CRUSHERS

Traylor

MINING WORLD



MACKS earn more . . . get more done . . . because PART FOR PART, MACK TRUCKS ARE THE BEST BUILT

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Only Macks have Mack-built transmissions. They're the finest units made, manufactured to standards no other automotive maker approaches. There's one for every trucking requirement—from four- to twenty-speed. And all are built for almost unbelievable endurance under maximum loads.

Only Macks have them . . . as only Mack trucks have the incomparable Mack engines, axles, cabs and frames. In fact, no other truck is *built* like a Mack, stands up like a Mack, or has the low-upkeep, high-performance, *higher* earning power of a Mack. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

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Mack-built, 20-
speed Quadruplex,
shown with gears and
shafts.



HERE'S WHAT MAKES MACK TRANSMISSIONS THE WORLD'S FINEST

- To make sure that Mack transmissions are untouched for strength and endurance, the exclusive Mack tetrapoid gears are drop forged, generator cut and case hardened.
- To give your drivers effortless, smoothly paced control through all speeds, Mack makes transmissions with closely spaced ratios and constant mesh, helical gearing.
- To make sure that every drop of fuel pays off in productive pulling power, Mack can give you gear ratios in regular progression through all speeds.
- To hold maintenance and upkeep expenses to a minimum, Mack provides transmissions with pressure lubrication of bushed bearings and with magnetic plugs.
- To assure long-lasting, stress- and vibration-free operation, Mack transmissions are designed to work in harmony with all other Mack components.

PRODUCTION EQUIPMENT PREVIEW



Full Data on Krebs Cyclones Now Available

Equipment Engineers Inc., 41 Sutter St., San Francisco 4, California, has recently published a new 16-page brochure #830. This booklet features installation photos and performance data on many widely diversified applications of the Krebs Cyclones. Excellent application photographs will insure your interest. Write to the company direct for your copy. Use reader service card.



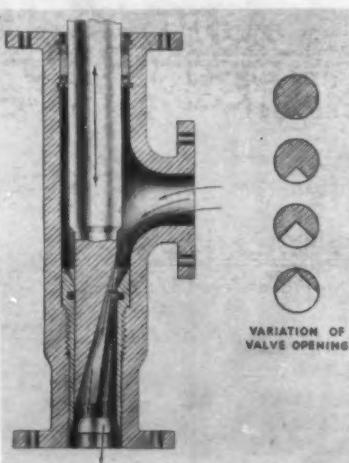
Huge New Rock Mover Has Payload Rating of 64 Tons

Kenworth Motor Truck Company has started production on one of the largest rear-dump semi models being built today. The Model 803-B has a rated payload capacity of 64 tons or 40 cubic yards struck. It is reported that the first 10 Kenworth 803-B's have been purchased by Kaiser Steel Corporation for use on ore hauls at the Eagle Mountain Mine in California. The rock mover is powered by a single 12 cylinder Diesel engine, with either a 400 or 600 horsepower version of this engine being offered. Measuring 41 feet 11 inches from front to

rear, the 803-B has a turning radius of only 37 feet with a turning angle of 30°. The drive axle is full-floating double-reduction with the first reduction a spiral bevel drive unit and final reduction through planetary gears in each wheel. The hoist is a single-acting, two-cylinder, three stage, straddle mounted unit. The dumping action moves the tractor back and under the trailer as the entire trailer raises. Circle No. 56 on the reader inquiry card.

Vibrating Hoppers Made For Rapid Loading of Skips

A heavy duty, vibrating hopper designed for rapid loading of skip hoists has been introduced by Simplicity Engineering Company, of Durand, Michigan. The hopper, measuring six feet square at the top opening, is mounted on a main frame with 14 heavy-duty coil springs to isolate vibration. The vibrating action is produced by a Simplicity double shaft Os-A-Veyor assembly. Tandem units may be mounted on a common main frame for use with twin skip hoists. In operation, these units empty 15 tons of moist ore into skips in an average of 5 seconds. The vibrating hoppers can be furnished in sizes and capacity to meet individual requirements. Circle No. 54 on the reader inquiry card.

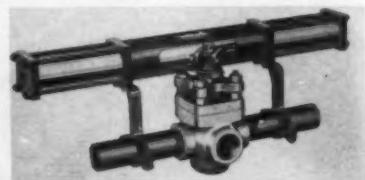


Clogging Reduced by Valve With Tapered Slot in Plug

A plug with a tapered slot controls fluid flow through a new valve offered by General American Valve Co., Corona Del Mar, California. Known as the Tapered Orifice Valve, the plug is moved into and out of a circular opening. A circular sealing ring eliminates by-pass. The function of the valve is essentially that of a needle valve. But it is said that

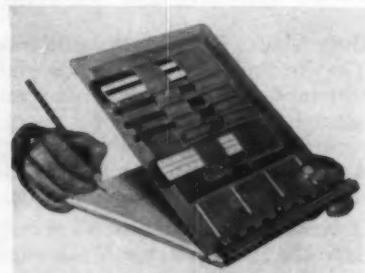
PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.

the Tapered Orifice Valve will pass foreign particles up to twenty times larger than comparable needle valves. The company reports that the use of this valve on the controls of a California hydraulic mining operation eliminated frequent clogging of the valves which had previously required shutdown for cleaning. Circle No. 59 on the reader inquiry card.



New Plug Valve Operators Offered by Ledeen Mfg. Co.

A new line of medium duty plug valve operators is now offered by Ledeen Manufacturing Company, Los Angeles. Designed for use with air, gas, oil or water at pressures up to 200 psi, the valve operators are adaptable to a wide range of control requirements including: Process cycling, safety and automatic shut-offs; or any combination of these requirements. The Model FM is for use on valves requiring relatively low torques. The Model TM is designed for valves requiring higher torques. The Model QM consists of two Model FM or TM operators mounted on a common bracket. The Model QM, in a given size, has twice the torque capacity of the same size FM or TM unit. Use reader service card.



Stratex Sheet Holder Handy for Field Work

Manufactured by Stratex Instrument Co., Inc., 3515 Sunset Blvd., Los Angeles 26, California, this aluminum sheet holder should prove to be useful for field engineers and geologists. Fabricated of non-magnetic alloy, this portable field desk built to accommodate 8% by 11-inch sheets, has a heavy mildew resistant cowhide pencil and scale pouch flush riveted to the lid. The pouch is compartmented to accept two standard pocket scales and four pencils. For further information write to company with reader service card.

SETTLING AGENT: Quartec For the Mining Industry is a new booklet issued by Special Commodities Division, General Mills, Inc. It shows the use of Quartec in ore concentration when utilized as an auxiliary reagent, settling agent or filtration aid. Write the company at 400 Second Avenue South, Minneapolis 1, Minn. for a copy of the 16 page brochure or circle no. 2 on the card.

DYNAMITE BAGS: The Chase Bag Company presently offers complete line of bags for explosives, used in connection with new blasting techniques. The firm has dynamite bags made of either laminated textile, multiwall paper or polyethylene. Circle No. 17 for additional information.

PRIMARY GYRATORY crushers manufactured by Traylor Engineering and Manufacturing Co. are fully described in a new bulletin published by the firm. Capacities of the units range from 345 tons per hour to 4100 tons per hour. For further information write the company at Allentown, Pennsylvania. Use the attached post card.

SPANISH CRUSHER bulletin published by the Nordberg Manufacturing Co. is now available. The brochure, printed in Spanish, describes the complete line of Symons Cone Crushers. Ask for bulletin 247-S on the attached post card, and send to the company at Milwaukee, Wisconsin, U.S.A.

SCREENS AND FEEDERS: Just completed, a new catalog describing the entire line of Simplicity Vibrating Pan-Type "Os-A-Vevor" and grizzly feeders is now available for you. Use the attached post card to write Simplicity Engineering Co., Durand, Michigan, for catalog number 571.

MOTOR STARTERS: Allis-Chalmers complete line of motor starters and contactors in sizes 4, 5, and 6 (Type 425), 50 to 400 hp, is described in a new 12-page bulletin released by the company. Copies of this bulletin #1488615, are available from Allis-Chalmers Mfg. Co., Milwaukee 1, Wisconsin. Use reader service card.

LIQUID CHEMICAL FEEDER: The Clarkson Co., a division of Equipment Engineers, Inc., 364 Market St., San Francisco, California, has available for you a new Bulletin #575, featuring the Clarkson Feeder Model E in 18-8 stainless steel for controlled feeding of liquids with precision and low cost. Write to company using reader service card for your copy.

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UPPER 3 CARDS ENABLE YOU TO WRITE THE MANUFACTURER DIRECT FOR FAST SERVICE

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NORDBERG'S LINE of four-cycle Diesel, Dual fuel and Spark Ignition Gas Engines are thoroughly described in a newly published 16-page bulletin, #257. The engines are built as supercharged; supercharged and intercooled; and Supairthermal units. Write Nordberg Mfg. Co., Milwaukee 1, Wisconsin for a copy.

HIGH ALTITUDE HORSEPOWER: The reduction of engine horsepower caused by operation at high altitudes can now be eliminated on the Caterpillar D8 Tractor by the use of a Normalizing Kit recently introduced by Caterpillar Tractor Co. The kit does not increase sea level horsepower of the tractor, but serves only to provide the needed oxygen to burn the same amount of fuel at high altitudes as at sea level. Write company in Peoria, Illinois, for further information. Use reader service card.

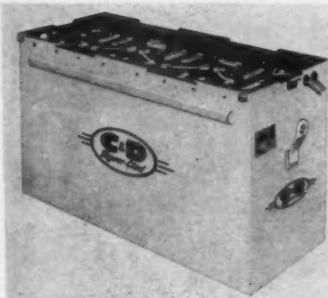
ROTO-CLONE DUST PRECIPITATORS are described in a new brochure published by the American Air Filter Corp. The new 16-page brochure describes the Type W dust collector. Among the distinguishing features described is the addition of a water spray to the basic principle of dynamic precipitation. The spray maintains a flowing film of water on collecting surfaces which lowers the water requirements to a minimum; traps even the lightest and finest particles; and delivers collected dust in slurry form for easy disposal. Circle No. 1.

LAKESHORE ENGINEERING have recently published a new catalog describing their entire line of mining equipment. The attractive 16-page brochure gives you information on many types of underground haulage cars, car dumpers, rotary tipper, winches, hoists, timber trucks, cages, skips, shaft rollers and safety dogs. For your copy of this informative brochure write Lakeshore Engineering Co., Iron Mountain, Michigan. Use reader service card.

PUMPS FOR DIAMOND DRILLING is the title of a publication dealing with transmission and single speed pumping units used in the diamond drilling industry. The material explains drilling practices and outlines the advantages of transmission pumps for most core drilling operations. For your copy write E. J. Longyear Co., Minneapolis 2, Minnesota.

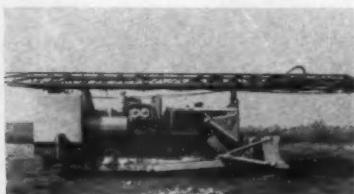
REDUCTION OF EARTHMOVING COSTS through the use of modern equipment design is the subject of a new booklet, "Cat Lowbowl Scrapers Keep Costs Low," recently released by Caterpillar Tractor Co., Peoria, Illinois. For your copy write company using handy reader service card.

List Information
you want MINING
WORLD to obtain for
you on this card. WE'LL
DO THE REST. NO
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if mailed in U. S.



C&D Heavy Duty Batteries Built for Long Life

C&D Batteries, Inc. of Conshohocken, Pennsylvania have recently published a new brochure, available for you, describing their line of underground haulage equipment batteries. According to the company the C&D battery Slyver-Clad construction give extra life and maximum capacity. Write the company, using reader service card for your copy.



Davey Produces a New Tractor-Mounted Drill

A new tractor-mounted rotary air drill is announced by Davey Compressor Co., Kent, Ohio. Known as Model M-8TA, the unit is said to be designed for extra heavy jobs under the most severe working conditions. It has a rated capacity of 10-inch blast holes and 35,000 pounds pull down pressure. The M-8TA uses compressed air for cleaning drilled holes and air pressures of 10 to 125 psi are available from a six-cylinder Davey 500 cfm capacity compressor. For further information write the company direct and ask for bulletin M-733. Use hand reader service card.



Continuous Cable Clamp Offered by Sauerman Bros.

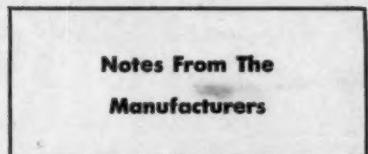
A new Continuous Cable Clamp made by Sauerman Bros. provides a quick way of attaching a load to a continuous cable. The clamp is used for car pulling, barge moving and other special rigging jobs. The three part fitting consists of a wedge clamp, wedge, and cable clip. To attach the load to the cable, the wedge clamp is placed on the cable with the small end

in the direction of the cable pull. The wedge is inserted and the cable clip passes through the eye of the wedge and locks it in place. A clevis and pin are frequently used to attach the load to the clamp. Circle No. 57 on the reader inquiry card.



New Front-End Loader Has Unique Pedal Controls

The Thew Shovel Company has announced production of the first model of their new line of rubber-tired front-end loaders which offer unique throttle and direction control. Called the Moto-Loader, the first model is a 4-wheel drive, 1½-yard capacity unit, designated Model ML-153. It is available with either gasoline or Diesel power and Allison Torqmatic transmission and integral torque converter. Two adjacent foot pedals—one for forward travel and one for reverse—give the operator instant direction control with one foot, while the other is used for braking. Under the forward-reverse foot pedals are additional accelerators, to provide travel speed control in either direction without removing the foot from the shifter pedals. Circle No. 58 on reader inquiry card.



Notes From The Manufacturers



Construction has begun on Allis-Chalmers Manufacturing Company's new \$3,250,000 engineering and research laboratory at Harvey, Illinois. The multi-million dollar expansion program will provide a central engineering building, an engine and material handling product development laboratory, and an engine test wing accommodating 32 engine dynometers. The building project will also include an experimental machine shop, a metallurgical laboratory, and a proving ground for material handling equipment.

Ray M. Ronald has been appointed manager of Hyster Company's tractor equipment division in Peoria, Illinois. Mr. Ronald was formerly sales manager of the company's western division with headquarters in Portland, Oregon. In his new position Mr. Ronald will be responsible for all activities connected with Hyster's tractor equipment division and the Peoria plant.

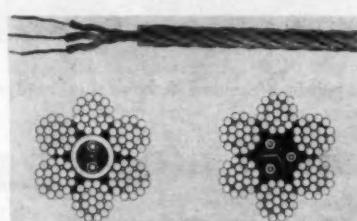
A new company, Mine Safety Appliances de Mexico, S. A. de C. V., has been established in Mexico City to handle the complete line of Mine Safety Appliance products. Arch S. Abbey, Latin American sales manager of the parent firm, Mine Safety Appliances Company of Pittsburgh, Pennsylvania, will be general manager of the new firm.

Fenton Hall has been appointed director of export sales for the Contractors Machinery Division of Yale & Towne in Batavia, New York. Mr. Hall, who has been associated with the company for 13 years, served previously as export manager for the British Materials Handling Division. Yale & Towne manufactures the Trojan line of tractor shovels.

Paul C. O'Leary has been appointed chief engineer of Shaft and Development Machines, Inc. and Machinery Center, Inc., both of Salt Lake City, Utah. Mr. Leary was formerly assistant to the engineer in charge of the rock drill engineering department of Ingersoll-Rand Company in Phillipsburg, New Jersey.

The Thew Shovel Company will manufacture a complete line of rubber-tire front end loaders in addition to its present line of power shovels and cranes. These loaders will be identified and marketed as "Moto-Loaders."

Dr. F. W. Lohmann has been appointed vice president in charge of engineering and research of Diesel Energy Corporation, New York City. The firm is the sole United States representative of Kloeckner-Humboldt-Deutz A.G. of Cologne, West Germany, which imports, services, and distributes Deutz Diesel engines.



Copper Wire Conductors in Core of New Wire Rope

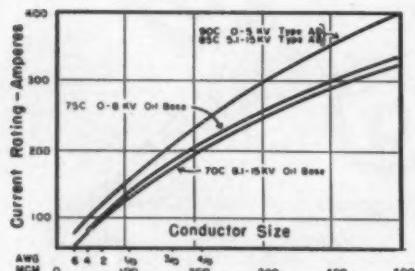
Designated as SignalKore Wire Rope, and manufactured by American Chain & Cable Company, Inc., Wire Rope Division, this new high strength wire rope can be utilized to transmit continuous communication instructions through its center core as well as transmit force for hoisting and other materials handling operations. According to the manufacturer SignalKore was made possible by the development of a practical method in which copper wire conductors are imbedded in a fiber core, which is then "laid-up" in a rugged steel wire rope. Write manufacturer at 929 Connecticut Ave., Bridgeport 2, Connecticut, for additional information.



PHOTO COURTESY OF HARNISCHFEGER CORP.

Anaconda butyl-insulated Shovel Cable powers 5-cu.-yard electrical shovel in Inspiration Consolidated Copper Co. mine.

New cable insulation stops heat failures cold!



85C and 90C operating temperature rating of Anaconda Type AB insulation is compared to lower ratings of ordinary insulation.

Shovel cables are running hotter today! Shovels are bigger. Loads are heavier.

With these tough new conditions, it is no wonder more and more mine operators are turning to Anaconda Shovel Cable insulated with Type AB butyl insulation.

This insulation has *inherent* resistance to heat. It stops cable failures due to heat—cold! In addition, Type AB insulation is tougher, resists

moisture and ozone, and has high dielectric strength.

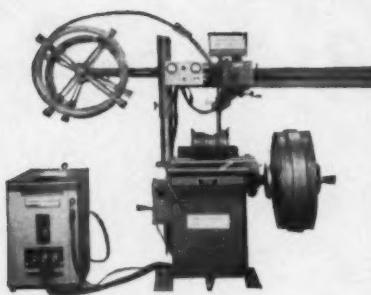
Neoprene jacket, too, is extremely tough and abrasion-resistant. Patented rubber cores cushion the ground wires and help prevent breaks.

For Shovel Cable or more information, call the Man from Anaconda or see your Anaconda distributor. Write for Type AB Bulletin EB-27. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 57117

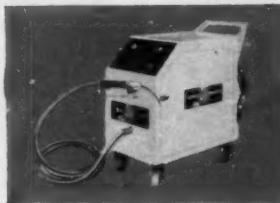
SEE YOUR **ANACONDA®**
DISTRIBUTOR FOR SHOVEL CABLE

How AMSCO helps you fight wear...

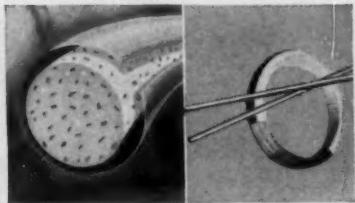
AMSCO® HARDFACING WELDING EQUIPMENT AND MATERIALS



Automatic welders

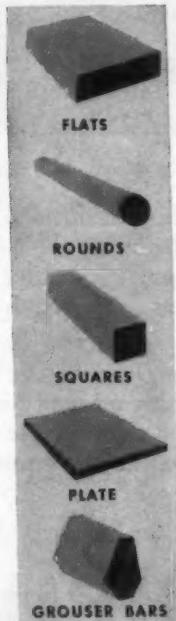


Semi-automatic MF welders



Manual, automatic rods & electrodes

Now you can get a hardfacing material to lick every type of wear. Impact alone! Impact plus abrasion! Abrasion alone! Amsco's line is complete and includes the new high-speed, more economical *tube rod* for semi-automatic build-up and repair. You'll save hours of down time, reduce welding time and materials cost . . . plus extending service life of your equipment... by using Amsco machines and hardfacing materials. Write for a complete description of this wear-fighter line.



AMSCO SHAPES • REPOINTERS of 12-14% manganese steel

Reinforce points of extreme wear with work-hardening
Amsco 14% manganese steel shapes. Truck beds, chutes,
crushers, blades, dippers . . . wherever impact
and abrasion cause early wear-out. Amsco shapes are
easy to weld, manganese to manganese, or manganese
to carbon steel. Size range is complete to fit all equipment.

Cast-to-shape repainters

For fast, easy re-pointing of teeth
used in less severe
digging.

Repainter bars

Three-foot bar
lengths. Also ideal
for rebuilding
worn lips of all dig-
ging equipment.

Wear-Sharp repainters*

Work up to 6 times
longer than stand-
ard repainters.
Corners won't
blunt. Entire cut-
ting edge wears
evenly. *Patented



Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.



AMSCO

AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS, ILLINOIS

THIS D4 DIGS OUT \$33,000 WORTH OF TURQUOISE A YEAR



You're looking at some of the richest rock in Colorado. Here, northwest of Villa Grove, gem turquoise comes out in chunks valued from \$30 to \$150 a pound. To get it, the Villa Grove Turquoise Lode Co. uses this husky Caterpillar D4 Tractor with No. 4A 'Dozer.

On a good day this D4 'dozes a hundred tons of rock and overburden and moves them a distance of some 200 feet. Last year it carved out over \$33,000 worth of turquoise.

Owner M. C. Winfield chose the CAT* D4 Tractor for this job because he liked its power. There's 50 drawbar HP in this machine, with a maximum drawbar pull of 10,700 pounds. There's sturdy quality built into every inch, from the long-life track pins and heavy-duty track rollers all the way into the rugged, dependable transmission. And Caterpillar's famed oil clutch, job-proven by thousands of hours of hard-working service, is available now on the D4.

Other important features include an exclusive all-weather starting engine (it gets mighty cold up in this Colorado country!) and a fuel injection system that squeezes power from every drop of low-cost, non-premium fuel.

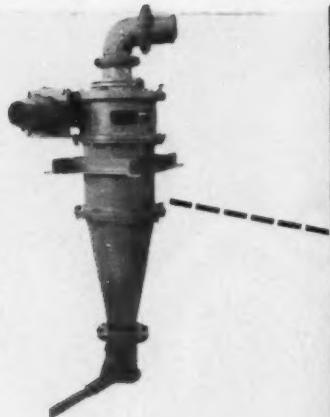
Your Caterpillar Dealer will be happy to demonstrate the D4—or any other of his big yellow machines—right out on your job. He's the man to call for expert service, too, and for replacement parts you can trust.

Caterpillar Tractor Co., San Francisco, Cal.; Peoria, Ill., U.S.A.

CATERPILLAR*

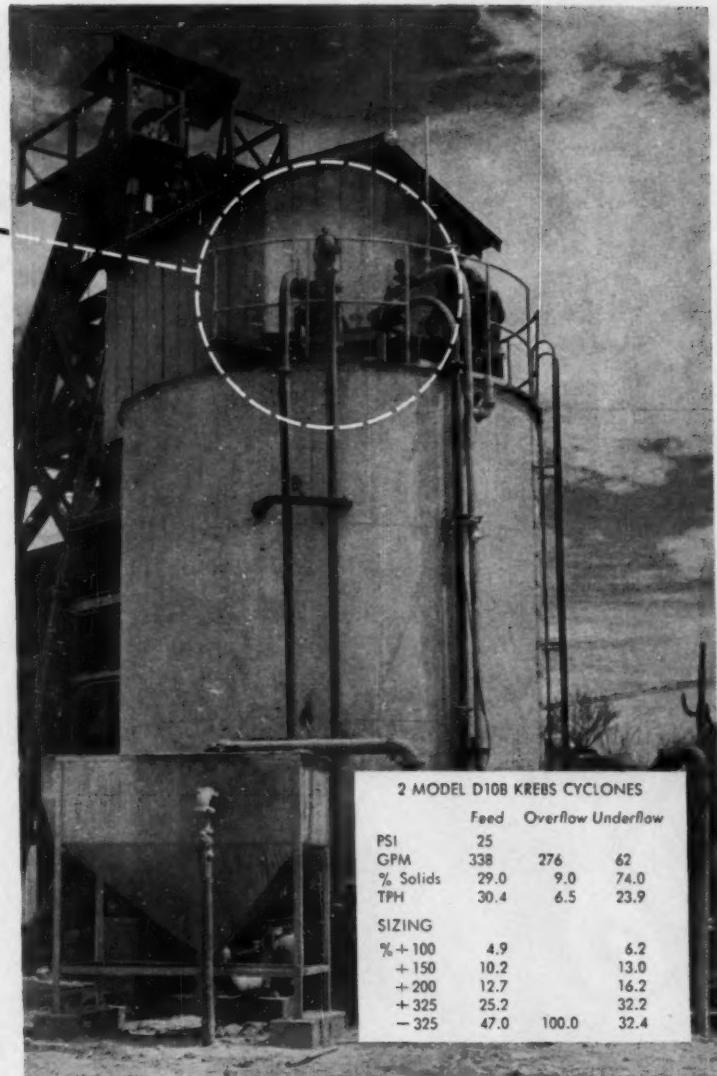
*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

NAME THE DATE...
YOUR DEALER
WILL DEMONSTRATE



MINE FILL FROM TAILINGS WITH KREBS CYCLONES

At the Banner Mining Company's copper operation near Tucson, Arizona, a sand fill drains sufficiently to drill from in 4 hours and ore is blasted down on the fresh pour the next shift. The fill comes from 2 Krebs Cyclones that produce close to an 80% yield from tailings. Although these tailings are fine and density high, the fill has an excellent percolation rate and set. In mining areas where water is plentiful, dilution is substituted for pressure and larger models of Krebs Cyclones are being used with ideal set and percolation rates.



2 MODEL D10B KREBS CYCLONES

	Feed	Overflow	Underflow
PSI	25		
GPM	338	276	62
% Solids	29.0	9.0	74.0
TPH	30.4	6.5	23.9
SIZING			
% + 100	4.9		6.2
+ 150	10.2		13.0
+ 200	12.7		16.2
+ 325	25.2		32.2
- 325	47.0	100.0	32.4

Send for brochure with photos and performance data on widely diversified applications of Krebs Cyclones.

Please fill out and mail.



Bulletin
830

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Manufacturers of Krebs Cyclones, Valves and Clarkson Feeders



WIRE ROPE AT WORK

Here is a drum of wire rope that obviously means business. It's a husky 1½-in. Bethlehem line, and there's 6,000 ft of it. Everything about the installation points to heavy-duty service. Everything also suggests careful maintenance and good housekeeping.

This is a slope-rope, one of a number in service at the Sunnyside mining operations of Kaiser Steel Corp. Some of

these ropes, Bethlehem Purple Strand grade, have been on the job as long as 18 months hauling over 1,500,000 tons of coal from the mine. Shows how ropes will really stand up—especially when properly spooled, maintained, and lubricated.

In mines and quarries all over the country, Bethlehem wire rope is relied on for the really tough jobs. Your nearest Bethlehem Wire Rope Distributor can give you speedy service. Or check with one of our sales offices: Los Angeles, Phoenix, San Francisco, Portland, Seattle, Spokane. Bethlehem Pacific Coast Steel Corporation.

Bethlehem Wire Rope is stocked by leading distributors throughout the West

BETHLEHEM PACIFIC





500' (IN 30' DEPTHS) PER 8-HOUR SHIFT in limestone, with 2 heavy-duty wagon drills and efficient Jaeger "600" air

power. Drilling is done in 2 lifts, first to 20', then a final 10' lift. Lewisburg Limestone Co., Lewisburg, Tenn.

Jaeger 600 "far more efficient", says quarry operator

Powers 2 heavy-duty drills averaging 500' per shift in limestone; engine speed under 1650 rpm

It takes plenty of constant 100-lb. air to power 2 heavy-duty wagon drills logging a fast 500' in limestone, each 8-hour shift. This Jaeger "600" rotary does the job for Lewisburg limestone, with ample air reserve, at easy, fuel-saving speeds that never reach 1650 rpm. This economical, slow-running performance cuts fuel costs, saves wear and tear on engine and compressor. "Far more efficient than the compressor it replaced," reports Lewisburg Limestone.

A Jaeger Roto "600", using the same Model 6-71 GM diesel engine, produces the same 600 cfm of air as other "600" compressors at 100 to 150 rpm slower speed (1650 rpm instead of 1750 or 1800). You cut fuel costs, reduce fpm of engine piston travel and save up to 9000 revolutions every hour you operate a Jaeger "600". Smaller Roto Air-Plus® units (125, 250 and 365 cfm) have the same slow-speed, high-efficiency performance.

It will pay you to get full details and prices from your Jaeger distributor — or ask us to send Catalog JCR-5.



MAKING LITTLE ONES OF BIG ONES: Jaeger "125" rotary keeps this hand-held rock drill operating at full efficiency by producing 125 cfm of 100 psi air at only 1700 rpm, instead of the usual 1800. You save the difference, in fuel and wear.

THE JAEGER MACHINE COMPANY

667 Dublin Avenue, Columbus 16, Ohio

PUMPS • CONCRETE MIXERS • SPREADERS • FINISHERS • TRUCK MIXERS

You need this hard worker...

JEFFREY

27-Ton, 4-Wheel Locomotive



This work horse gives you plenty of power to pull heavy pay loads with 380 total horsepower available.

Jeffrey 27-ton, 4-wheel locomotives are driven by two motors having sufficient power to slip the wheels. This assures maximum "haul ability" with a rated drawbar pull of 13,500 lbs. at a speed of 10.8 mph.

Outstanding operating and safety features may include: roller-bearing type journal boxes and motor axle suspensions—air and dynamic service brakes—automatic couplers with air-operated uncoupler—trolley with air-operated retriever—separate blower for each motor—32 volt battery-operated control and headlights.

You can depend upon this mine locomotive for day in and day out operation with a minimum of maintenance.

Catalog 836 describes all types of Jeffrey mine locomotives. The Jeffrey Manufacturing Company, 861 North Fourth Street, Columbus 16, Ohio.



JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT...TRANSMISSION MACHINERY...CONTRACT MANUFACTURING

precipitates—SOUTHWEST

U.S. Court Commissioners Hear Gold Claimants

During the last few months Commissioners of the United States Court of Claims travelling in the west heard individual claimants in regard to their damage suits against the Federal government for World War II gold mine closures. Several of the individual claimants who are advanced in years, and in rather precarious health, asked that their testimony be preserved so that traveling commissioners heard their testimony.

Meanwhile, in Washington, informed attorneys report that the voluminous record has been prepared by the clerk of the Supreme Court, that it totals 1,611 pages in two volumes, and is available to all parties concerned. The attorneys for the Department of Justice are working into their draft brief all record references to conform with the printed record so that the brief should be printed and distributed about November 1. After this distribution the respondents have 30 days in which to file their reply brief.

It now appears certain that the record before the Supreme Court will be completed by about the middle of December. In so much as the cases are on the so-called Summary Calendar, only a 30-minute argument is allowed for each side so the chances are favorable for the actual testimony to be heard by the court about the first of March.



Asbestos producers in the Globe, Arizona, district, report that deliveries under the government's renewed purchase program have totaled approximately \$300,000 worth of material. Shipments have been composed of about one-half Grades No. 1 and 2, and one-half Grade No. 3. The largest shipper has been *Metate Asbestos Company* of Globe, Arizona, from its *Apache and Bear Canyon* properties on the San Carlos Indian Reservation. According to Jack L. Neal, manager, producers in the area are continuing their efforts toward obtaining suitable milling facilities and report some encouraging developments.

The old *Keystone* mine near Dragoon, Arizona, is being reopened under lease by the *Aztec Mining and Development Company*. Principals in the leasing concern are: Harold and Phil Stevens and Harry Lehman, all of Tucson. So far, most of the work at the mine has been preliminary to production and includes repair of the O. K. shaft headframe and shaft collar, removal of broken ore from stopes on the 110-foot level, and test shipment of two carloads of ore from surface stockpiles. Actual mining on the 110-foot level is planned for an early date with shipments going to the *International Smelting and Refining Company* smelter at Inspiration, Arizona. The Keystone property is controlled by Norman M. Rehg and associates of Dragoon.

Following the September break in the copper price, *Phelps Dodge Corporation* announced an additional five percent cutback in its Arizona mining and milling operations. Previous production cuts were

made in November 1956 and March 1957. The combined effect of the three curtailments is a reduction in production of about 3,500 tons of copper a month, or 15 percent. The new working schedules by which the curtailment will be accomplished calls for the *Morenci* and *New Cornelia (Ajo)* branches and the *Lavender* open-pit mine to operate 11 days, followed by a three-day shutdown in each two-week period. These divisions have been operating 23 days out of each 28. At the *Copper Queen* branch underground mines, the working schedule was reduced from a standard six-day week to an alternate six and five-day week.

Aricana Senator Mining Corporation, wholly owned subsidiary of *Abbcian Mines Ltd.* of Toronto, Canada, will have a 200-ton-per-day mill in operation at its gold-silver-base metal prospect near Prescott, Arizona. The mill will be erected by a private financing group and then will be leased to Aricana. Aricana also has an option to purchase the mill one year after it has been in operation for a sum equal to its cost plus 10 percent.

The Aricana property is held under a 99-year lease.

The *Ray Mines Division of Kennecott Copper Corporation* was closed for a short period in October to make its biennial inspection of turbines in the power plant.



The official dedication of the opening of the new *U. S. Borax & Chemical Corporation* open-pit mine and refinery at Boron, California is being held on November 14. This \$20,000,000 project which has required more than two years to complete, will produce about 70 percent of the free world's total supply of boron. The new operation represents the first time borax has ever been mined by the open-pit method. The huge 175-foot-

Enter Your Mine in National Safety Contest

The U.S. Bureau of Mines' 33rd National Safety Competition is under way.

This is your chance to register your mine in the contest for the best safety record in any of these categories:

Metal Mines (Underground) Nonmetallic Mines (Underground) Open-pit Mines

Of the 525 mineral-producing operations in 43 states competing in the 1956 contest, 200 went through the year without a disabling injury. These injury-free mines and quarries operated a total of more than 20,000,000 man-hours last year.

Each winner receives a bronze "Sentinels of Safety" trophy donated by the "Explosives Engineer" magazine.

Fill out the application blank and mail it at once to Accident Analysis Branch, Bureau of Mines, Washington 25, D.C.

It is desired to enroll the plant described below in the National Safety Competition. Complete data on injuries and exposure-to-hazard as required by the rules of the competition will be reported to the Bureau of Mines. The following information describes the enrolled operation:

Name of mine or quarry

Location: (Nearest town) (County) (State)

Check kind of plant: Underground Open-cut or strip Quarry

Kind of mineral or stone produced:

Estimated average number of men to be employed per operating day:

Underground ; Cut, strip, or quarry ; (Outside include only surface workers as associated shops, yards, and crushing plants)

Address to which correspondence regarding this Competition should be mailed:

(Street) (City and Zone) (State)

Very truly yours, Signature

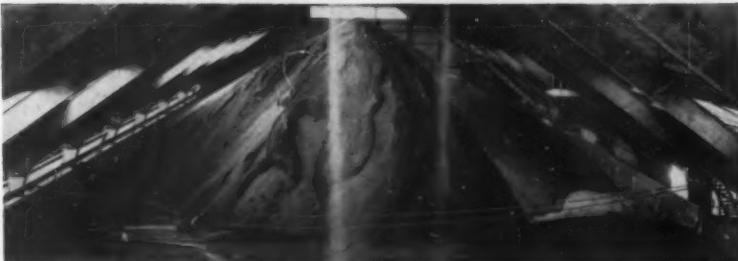
..... Title

..... Company

..... Address

(ENROLL ONLY ONE PLANT
ON THIS APPLICATION:
ADDITIONAL BLANKS WILL
BE SENT UPON REQUEST.)

Three Sauerman Methods for Cutting Storage and Reclamation Costs



INDOOR RECLAMATION

DragScraper with Trolley and Monorail

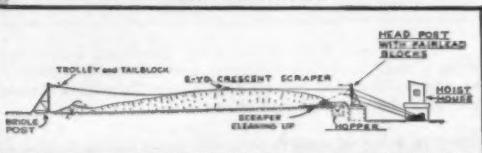
—Material dropped onto stockpiles from an overhead conveyor is reclaimed to hoppers by a 2½-cu. yd. DragScraper. The installation uses a monorail and trolley system to permit shifting of the scraper bucket by remote control from operator's station at right.—Sauerman News No. 143.

OPEN STORAGE



DragScraper with Trolley and Elevated Bridle

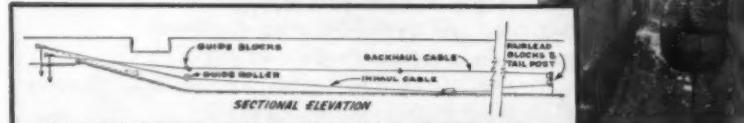
—DragScraper is reclaiming raw potash to hopper from storage pile. Material is dumped at rear of the pile and moved closer to hopper during intervals when mill requirements are satisfied. Trolley and tail block travel on an elevated bridle between two stiff-leg bridle posts. Shifting of the trolley is provided by a third drum on the Sauerman DragScraper Hoist.—Sauerman News No. 146.



HANDLING HOT MATERIAL

DragScraper—Hot scale is dropped from ingot buggy track into tunnel and is conveyed by DragScraper to a water sluiceway for disposal. Safety is important here—personnel and vulnerable equipment do not enter the hazardous area.

—Sauerman News No. 146.



Find out what the Sauerman Method can do for you

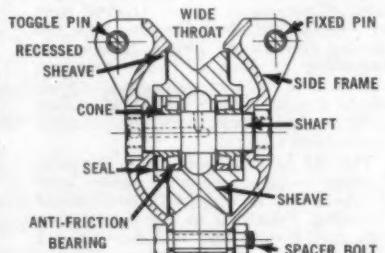
Give us details on your operation. Our engineers will give prompt recommendations and work with you to provide the best method for your requirements. Ask for Catalogs A (DragScrapers) and E (Bulk Storage by DragScraper).

SAUERMAN BROS., INC. BELLWOOD, ILL.
Cable: CABEX—Bellwood, Ill.

Crescent Scrapers • Slackline and Tautline Cableways • Durolite Blocks



Take one apart and you'll see why they stay underground and give you years of dependable, trouble-free service. Model 6 WT with shackle weighs 34 lbs. Model 8 WT with shackle weighs 81 lbs. For more detailed information on these and other Pacific Sheave Blocks, send for Bulletin No. 271.



Solid side frames. Extra-heavy construction of both groove and flanges. Made of heat-treated alloy steel for maximum toughness. Sheave is recessed into side frames to prevent rope fouling. Roller bearings are grease-sealed to prevent entrance of foreign matter.

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MINING WORLD

SOUTHWEST

deep pit from which 9,000,000 tons of overburden has been removed, exposes the largest deposit of sodium borate known in the world and permits virtually a 100 percent recovery of ore.

Hambergerite, a rare beryllium borate mineral [Be₂(OH)BO₃] has been discovered in California, according to the California Division of Mines. No other occurrences of this mineral are known in the Western Hemisphere; it is found generally in Scandinavia, Madagascar, and Kashmir, India. The new find was made in the *Little Tree* mine near Ramona, San Diego County, California.

Stanford Research Institute at Menlo Park, California plans to expand present research facilities into a \$500,000 Metallurgical Laboratory. Work has been underway on this enlargement for some time, and all of the equipment is to be installed by January 1, 1958. New testing facilities include tensile and creep-rupture equipment. Process equipment includes a vacuum induction and a consumable electrode cold mold melting furnace. Activities of the Metallurgy Department include work in electrochemistry, physical metallurgy, process metallurgy, and liquid metals.

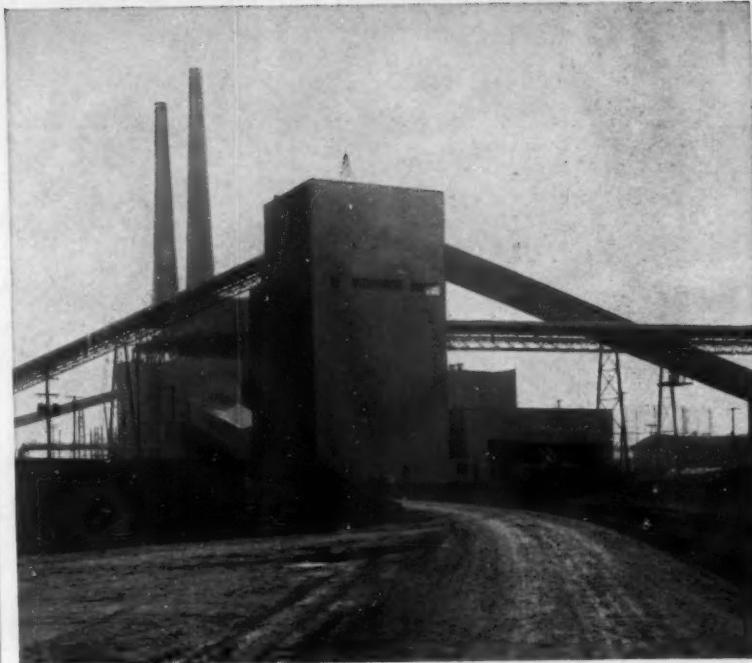


American Potash & Chemical Corporation, Food Machinery & Chemical Corporation, and National Distillers & Chemical Corporation have formed a new firm, AFN, Inc., which has an Air Force contract for development and semi-pilot plant work on boron fuels. AFN will operate, initially, at American Potash's plant at Henderson, Nevada.

The Nevada AEC test organization has had an agreement with Wah Chang Mining Corporation over the past few months regarding evacuation of the mine area during AEC tests. The Lincoln mine of Wah Chang is less than 45 miles from the center of the Nevada test site and only 35 miles from some Yucca firing areas. The government paid the mine management \$15,000 a month for three months, starting September 1; the company then had its personnel leave the area and paid costs of their absence. A similar agreement was reached with Dodge Construction Company. According to the AEC there would be no damage to water supplies, food supplies, or in any way contaminate the mine.

In line with its continuing efforts to reduce operating costs, and thereby remain competitive in the weakening copper market, Kennecott Copper Corporation's Nevada Mines Division made a further reduction in personnel. Of the division's nearly 1,900 employees, about 125 have been affected immediately, and another 50 positions were under study. An earlier reduction was made last March when copper was selling for 32¢; at this writing it is down to 27¢.

The Mt. Grant Mining Company is now working the old Mingle gold property located at 10,000 feet on Mt. Grant near Hawthorne, Nevada. Ore will be trucked to the railhead at Thorne where it will be shipped for milling.



Moves a million-ton mountain of coal a year!

One of the largest in the U. S., this system depends on over 7,000 feet of Quaker Rubber belting to keep the coal moving.

PROBLEM: The Detroit Edison Company needed three separate conveyor systems to carry coal into their River Rouge power plant: (1) dock to storage, (2) dock to breakers to plant, (3) storage to breakers to plant.

SOLUTION: Quaker engineers and the Quaker distributor's men, working with engineers of the power plant, suggested the use of a belting designed for high lifts and long center distances. Over 7,000 feet was installed.

RESULT: The three conveyor systems work smoothly and efficiently, carrying coal into the plant at the rate of one million tons a year.

YOUR PROBLEM: Whatever your conveyor needs, whatever your industry—there's a Quaker Rubber Belt (or Hose) of the right construction to handle the



To make sure 7,000 feet of Quaker Rubber conveyor belting (available in 48", 60" and 72" widths) was properly installed, splicing and vulcanizing of the belting was supervised by a Quaker Rubber specialist.

job safely and economically. Quaker engineering service is available for the asking.

For your free brochure on conveyor belting, write your nearby Quaker Rubber distributor, or:

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Quaker Rubber Works,
Philadelphia 24, Pa., or
Pioneer Works, Pittsburg, Calif.

H. K. PORTER COMPANY, INC.
QUAKER RUBBER DIVISION



*Christensen
Cooperation in
the field gives*

Reality in Research

Result:

**96.7%
CORE RECOVERY**

*Christensen equipment
is engineered for the
job, there is a bit and
barrel design adaptable
for your coring or
drilling problem.*

"less cost per foot"

Wherever and whenever the operator has a problem the Christensen Diamond Products Company Engineer is available for consultation and advice.

This teamwork between CDP engineer and operator solves the problems where they are, in the field. A recent example

occurred in the Gas Hills of Southwestern Wyoming: Core recovery was running only 40 to 60 percent. The problem was first thought to be the failure of core catching devices, but the Christensen engineer with the driller, pinpointed the problem to circulation. Result: a new barrel and bit design that increased core recovery to 96.7%.

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH 2nd WEST • SALT LAKE CITY, UTAH



SOUTHWEST

Eureka Corporation is reducing operations at its *Ruby Hill* mine in Eureka County, Nevada because of metallurgical problems. The lead-silver-gold ore has an arsenic content which is causing some difficulty at the smelters.

Kirth Grimes and two associates believe they have located a good copper vein on their property 15 miles northeast of Gabbs, Nevada. They have sunk one shaft to a depth of 100 feet, and another to about 20 feet.



Kermac Nuclear Fuels Corporation has its new 3,000-ton-per-day uranium mill under construction and expects completion by September 1958. Cost of the mill, to be one of the largest in the country, is estimated at about \$16,000,000. Under its contract with the AEC, Kermac estimates that minimum sales value should be from \$300,000,000 to \$350,000,000. This is based on an estimate of 40,000,000 to 46,000,000 pounds of uranium oxide being produced and sold to the Commission during the period ending in 1966.

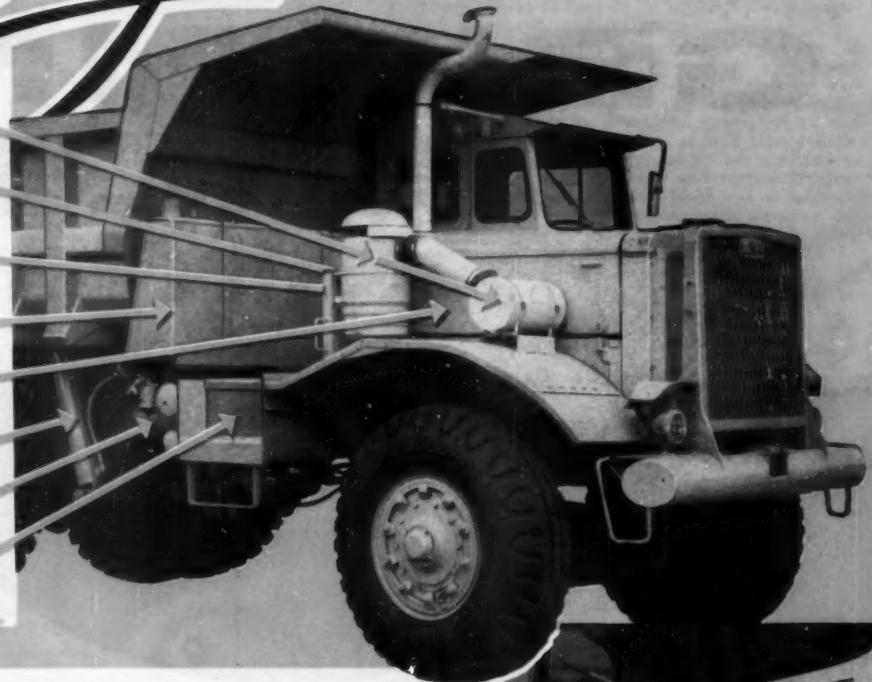
United Western Minerals Company is shipping from its *Silver Bit* mining claims on Sec. 10, T. 14 N., R. 12 W., in the Ambrosia Lake district of New Mexico. United Western is the operator on this farmout with *Monitor Exploration Company* retaining an interest in the properties. Approximately \$3,000,000 worth of uranium ore has been blocked out on another farmout property, the *Colamer* property. This ore will be contributed to the *Homestake-New Mexico Partners* mill by United Western and its farmout partners on a 50-50 basis. Other properties obtained from Colamer will be drilled in the near future.

Dow Chemical Company is preparing to start construction of its \$500,000 chemical distribution plant four miles northwest of Grants, New Mexico. A switch and spur line are already being built by the Santa Fe Railroad. The plant is to be a "service station" for uranium producers and other mining concerns in the southwest. It will be equipped to handle storage and distribution of 50 percent caustic solution, soda ash, and other Dow chemicals for the mining industry. It is hoped that the plant will be ready to supply four of the mills when they go into operation in 1958.

Now in progress at *Kenecott Copper Corporation's Chino Mines Division* operations is a long-range program to convert electric shovels now in use with 4½-yard and 5-yard dippers to 6-yard dippers. It will be several years before all nine of the shovels are equipped. Chino's latest shovel is an 8-yard model, larger than any now in use at the mine. It is being assembled in the *Santa Rita* pit. The company is currently disposing of \$1,147,600 worth of buildings, land and equipment in Santa Rita and Hurley, New Mexico. The property is going to civic, religious, educational, and fraternal organizations in these two towns. This is part of company policy of "getting away from the paternalism of the old fashioned company town."

Easy to get at

- OUTSIDE MOUNTED AIR CLEANERS
- POWER STEERING RESERVOIR
- ENGINE FULL-FLOW FILTER
- FUEL TANK
- ENGINE OIL DIPSTICK AND FILLER
- HOIST CYLINDERS
- FUEL, LUBE OIL AND TRANSMISSION FILTERS
- BATTERIES



Designed for Service Accessibility! Engineering on Kenworth rock and ore movers is thorough. Kenworth is concerned not only with building for over-capacity, but also with designing so that routine maintenance is accomplished with the least possible effort in the shortest time. Components requiring frequent or daily servicing are all grouped conveniently on one side of these rock and ore trucks.

Ease of service accessibility, combined with the extra strength and durability built into every inch of Kenworth's rock and ore haulers, assure you lower operating costs. To make certain you get trucks that keep on the move for more working days, bring your transportation problems to Kenworth for consultation. The result—greater profits for you.

Kenworth's famous "inside-out dash" has been adapted for use on the rock and ore movers—assuring easy access from the outside.

**There's more WORTH
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KENWORTH

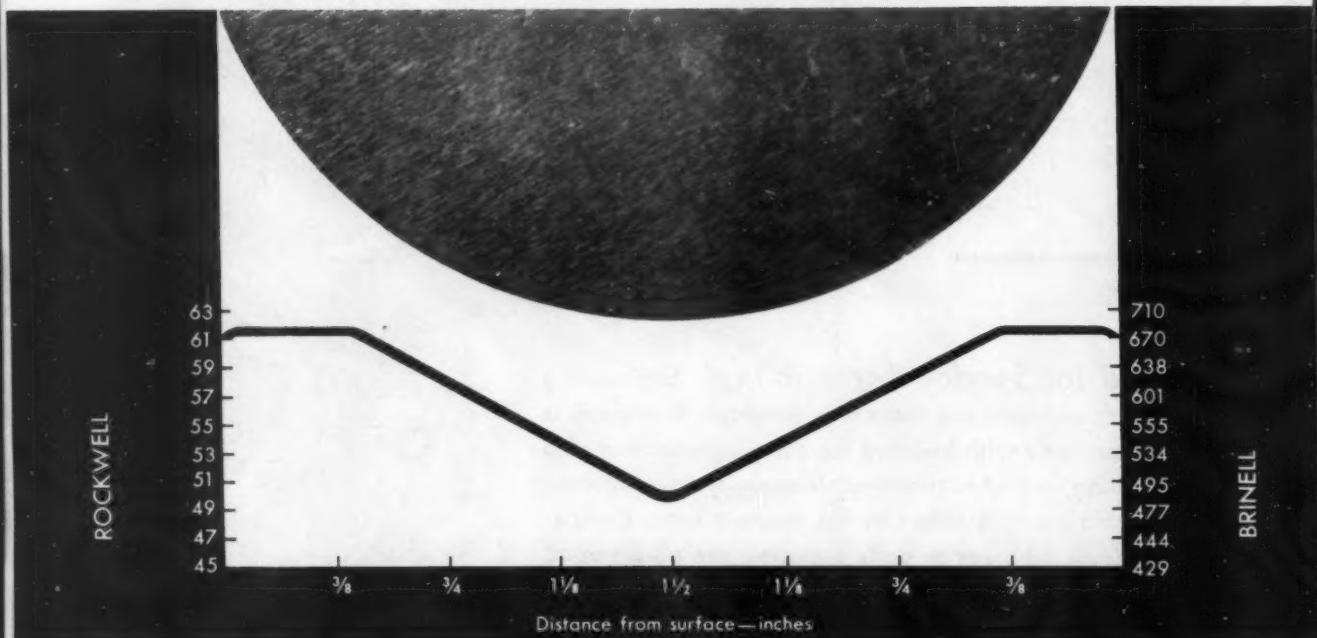
MOTOR TRUCKS

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controlled metal hardness means
heat-treated cast alloy steel

NACO GRINDING BALLS

cut per-ton grinding costs



Note how new casting process and full heat treatment show controlled hardness between surface and inner core.

Spectrographic analytical control of elements in steel making processes and controlled heat treatment assure the desired metallurgical grain structure which produce the type of hardness required for maximum wearing qualities.

Performance reports on Naco solid cast alloy steel grinding balls from mills now using them have been universally favorable—both in lasting qualities and impact absorption.

Structurally, they possess a grain

closely approaching tool steel—tough, hard and rugged for long lasting qualities. Laboratory tests show a remarkable uniformity in solidity, both under X-ray and specific gravity tests, with controlled hardness holding to a desired depth.

AA-5059



CAPITOL FOUNDRY DIVISION

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precipitates—CENTRAL AND EASTERN



Consumption of acid-grade fluorspar will be increased by 40,000 tons a year if aluminum plants now under construction are operated at full capacity, according to J. Blecheisen, president of the *Rosiclare Lead and Fluorspar Mining Company*. Consumption of acid-grade spar by aluminum plants in 1956 was 100,000 tons. Rosiclare Lead and Fluorspar was one of four companies in the Illinois-Kentucky fluorspar district which played host to members of the St. Louis Section of the A.I.M.E. last month when they toured six mines and four mills in the area.

Calumet & Hecla Inc., reports that although it is suspending production from some of its high-cost copper mines, development work will continue. Some of the working force is being transferred to high-grade mines to increase production, and surface and service activities are being streamlined to fit the modified mining activities. Explorations in Upper Michigan are being expanded with the adoption of newly developed techniques not previously used in the area to add to ore reserves.

The *Oklahoma Geological Survey* is now studying samples from a uranium deposit discovered at the town of Cement in Caddo County. Further investigations of the deposit are also being made jointly

at the site by the Survey and the Atomic Energy Commission.

Calumet & Hecla, Inc. has transferred its Geological Department to the Calumet Division. It had been part of the corporate offices. James Pollack will continue as chief geologist with headquarters at Calumet, Michigan.



Magnet Cove Barium Corporation is reported to be optioning land in the Del Rio barite district of East Tennessee. Negotiations are said to be underway between Magnet Cove and *New Jersey Zinc Company* for purchase of the Williams barite mine from New Jersey Zinc. This mine, though now inactive, has been the largest producer in the district. The ore at the Williams occurs in a low angle thrust fault with a thickness of 6 to 10 feet. Previous mining has been by the room and pillar method.

The *Mallory-Sharon Metals Corporation* has been formed by *P. R. Mallory & Company*, *Sharon Steel Corporation*, and the *National Distillers and Chemical Corporation*. The new firm will have assets worth \$55,000,000, thus exceeding the *Titanium Metals Corporation of America*, the only other integrated producer of titanium products. National Distillers will contribute its facilities for production of zirconium and titanium sponge

to be completed this year, the plant will have an annual capacity of 10,000 pounds of titanium sponge and 2,000,000 pounds of zirconium sponge. It is located in Ashtabula, Ohio. The new company also acquires *Reactive Metals, Inc.*, now jointly owned by *National Distillers* and *Mallory-Sharon Titanium Corporation*. It was formed to do research and development work in zirconium metal.

Hooker Electrochemical Company of Niagara Falls, New York and *Foote Mineral Company* of Philadelphia, Pennsylvania are exploring together possibilities for the development, production, and sale of components of high energy fuels. Currently their interests are confined to lithium perchlorate and ammonium perchlorate, materials which act as oxidizers in fuels for rockets and missiles, but studies may be extended later to other high energy fuel components.

A corporation headed by W. B. Thweet of Augusta, Georgia plans to reopen an old emerald mine in the Blue Ridge Mountains of North Carolina. The mine was discovered in 1885, operated by *American Gem & Pearl Company* until 1904, and then reopened for subsequent test work in 1919, 1935, and 1942. Three shafts have been sunk but only one is said to have been drilled to a depth sufficient to hit an emerald pocket.

Several Beaufort County, North Carolina landowners have signed options with *Bear Creek Mining Company*, exploration subsidiary of *Kennecott Copper Corporation*. The company is seeking options on 350,000 acres of potential phosphate-bearing property in the county, and has opened offices in Washington (North Carolina), Belhaven, and Bath so that



Recovering Phosphate from Hillside Deposits in Tennessee

Using a combined dragline and tractor method for stripping overburden from phosphate deposits lying 60 feet below the surface of a hillside contour deposit has resulted in a top production of 1,500 tons per day for M. C. West of Columbia, Tennessee. Two large tractor-bulldozer units cut about two-thirds of the clay and broken flint overburden away, pushing it down the hillside. The remaining cover is recovered by a dragline which strips a pit around a hill about 100 feet wide, from which the phosphate matrix is removed by a small dragline loading tandem trucks. Operation is a continuous process, the bulldozers starting a new pit up the hill, as the material is removed from the lower pit. This is one of a group of independent mines in the area around Columbia which supplies phosphate for both industrial and agricultural use in Maury and Hickman counties. Since the chemical plants require a 25 P₂O₅ grade of phosphate to feed the electric furnaces, an important part of

West's operation is a second deposit at the mine site, which was opened in March of this year. The pit is similar to the first one, but smaller. Producing a 23 P₂O₅ grade, this deposit outcrops about 150 feet from the summit of the hill and goes through the hill on a corresponding level to the opposite side of the hill. In the picture at left above, a Caterpillar D13000-powered Koehring 605 1½-yard dragline loads the ore into trucks which are sent to the processing plant at regular intervals to counterbalance the loads of higher grade ore from the other pit about 500 yards away. The firm also operates a washing plant on the bank of Duck River. In the picture at right above, a Caterpillar D7 tractor with bulldozer is moving material from a stockpile at the top of the hillside and dozing it into the hopper where high pressure water turns it into a mud solution. After three washings the matrix is stockpiled until ready for shipment to nearby processing plants for manufacture into fertilizer.

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CENTRAL AND EASTERN

land owners may contact Bear Creek officials to discuss option agreements. The *North Carolina Pulp Company* has signed over between 40,000 and 60,000 acres to the mining firm.

The Maine Geological Survey Division has issued the first in a series of mineral resources reference maps which will assist in locating mineral occurrences in the state. This first map, called the Bangor Sheet, covers an area of about 6,700 square miles between Bowdoinham and North Anson on the west boundary and Schoodic Point and Beddington on the east boundary. It may be obtained from the State Geologist at Augusta, Maine for 25¢.

New estimates have been made by the U.S. Geological Survey of the reserves of mercury ore in the United States. Total reserves of all classes of ore amount to 315,300 flasks, of which approximately half is measured or indicated and the remainder is inferred. Current domestic production is at the rate of about 30,000 flasks a year, and domestic consumption has required about 55,000 flasks a year during the last two years.

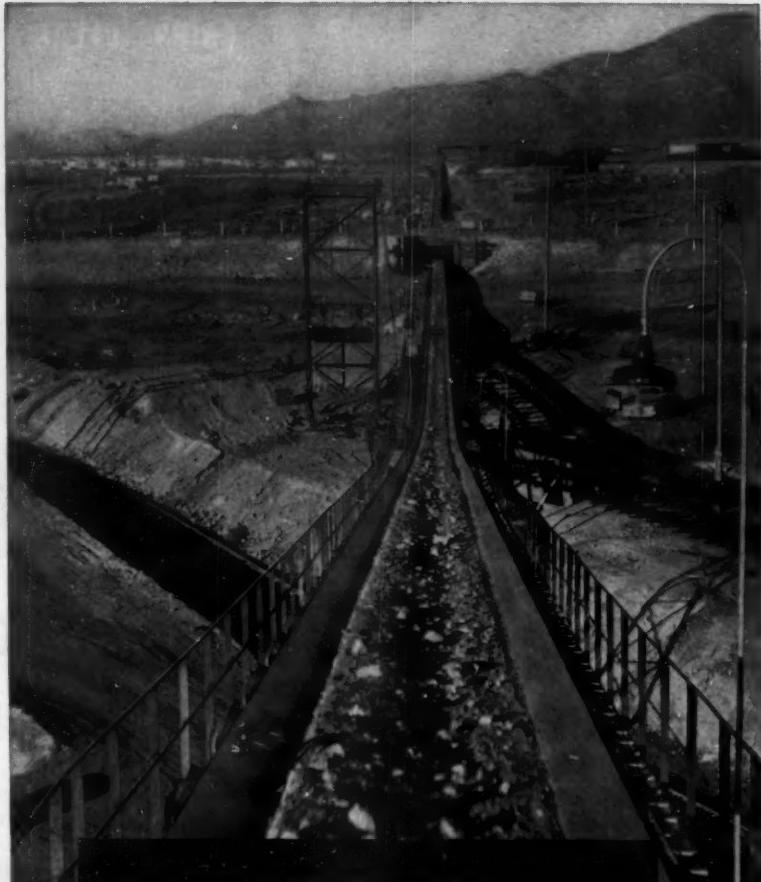
Alabama Metallurgical Company has started construction of a \$4,500,000 magnesium plant at Selma, Alabama. Initially, the plant will produce 6,000 tons, but ultimate capacity will be 12,000 tons of high-purity magnesium per year. Alabama Metallurgical is owned jointly by *Dominion Magnesium Ltd.* of Canada and *Brooks & Perkins Inc.* of Detroit, Michigan. Dominion will provide the use of the Pidgeon ferrosilicon process.



The steamer J. A. Campbell was the first vessel to load taconite pellets at the new Taconite Harbor, Minnesota. The new plant is scheduled to be completed about the first of the year, and will be capable of providing up to 7,500,000 tons per year of taconite pellets containing about 64 percent iron. *Pickands Mather & Co.* is managing the project for *Bethlehem Steel Corporation*, *Youngstown Sheet & Tube Company*, *Interlake Iron Corporation*, and the *Steel Company of Canada Ltd.*

The *M. A. Hanna Company's Musser mine* on the Cuyana Range is scheduled to begin shipping iron ore early in the 1958 season. A dragline-conveyor system has been stripping the property this season.

Ashland Mining Corporation reports that completion of analytical and other test work on 880 acres of land in Agenda Township near Butternut, Wisconsin, has proved the existence of iron-bearing material, and that a mine and concentration plant for production of high-grade concentrate would be economically feasible. Unofficial estimates of the property indicate a reserve of 250,000,000 tons of crude ore from which 70,000,000 tons of high-grade concentrate can be derived. Preliminary engineering for a concentrator is under way for production of 1,500,000 tons of iron ore pellets annually. Actual production could not start



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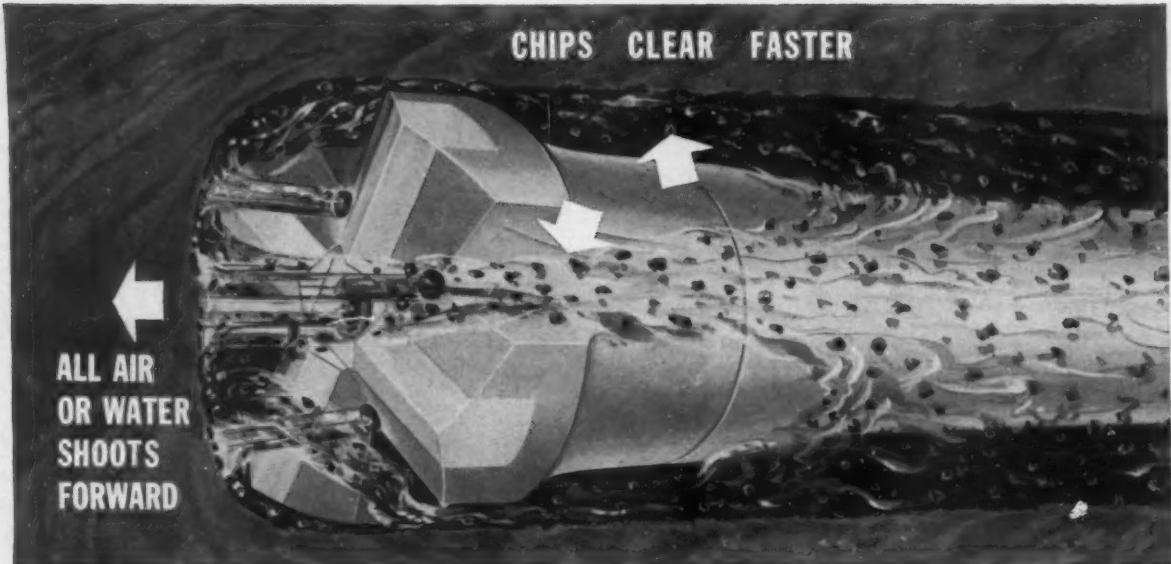
To help build Southern Pacific Railroad's 13-mile roadbed across Great Salt Lake, Morrison-Knudsen Co. had Hewitt-Robins develop a bulk materials handling system. In ton-miles-per-hour capacity, this system surpasses any previous belt conveyor installation. Its conveyors travel at speeds up to 850 fpm, carry 75,000 tons of rock and gravel per day, load barges at 12,000 tons per hour.

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CENTRAL AND EASTERN

until 1960, however. Development of a process for this ore was undertaken by Erie Laboratory of *Pickands Mather & Co.* Pilot plant work on 1,850 tons of ore has been in progress since last fall. *McLouth Steel Corporation* owns 50 percent of Ashland.

Shipments from *Reserve Mining Company's* taconite operations at Silver Bay, Minnesota, have already exceeded those of 1956. Total for the year is expected to be around 5,000,000 tons; in 1956 3,548,888 gross tons were shipped. Reserve is currently expanding its finished pellet storage area at Silver Bay.

Lake Superior iron ore shipments are expected to total about the same as last year, with the season winding up earlier. To October 1 of this year, 69,502,127 tons had been shipped or about 14,800,000 tons more than at the same time last year. Because of the strike in 1956, the season was extended into December, where weather permitted, in order to meet demand. Final figures for 1956 reached 77,833,027 tons. It is expected that shippers this season will easily reach this goal sometime in November, and the flow of ore is already slowing down.

Iron ore prospecting permits awarded this year by the Minnesota State Executive Council and the Commissioner of Conservation were as follows: *Pacific Isle Mining Company* of Hibbing, two permits covering part of *Atkins* mine near Kinney and a section of land near Mountain Iron; *Pittsburgh Pacific Mining Company* of Hibbing, one permit covering land near Buhl; *Coons Pacific Mining Company*, Hibbing, one permit covering stockpiled lean ore near Mountain Iron containing about 165,000 tons of low-grade ore produced at *Mott* mine; *U. S. Steel Corporation*, Duluth, two permits for land about five miles northeast of Aurora; *Ontario Iron Company* (*Pickands Mather & Co.*, agents) one permit for *Forsyth* mine which is now idle.

Pickands Mather & Co.'s Buck iron ore mine at Caspian, Iron County, Michigan won a top safety honor in the underground group of metal mines for working 493,207 manhours without a disabling injury. The U. S. Bureau of Mines also awarded a safety honor to *Bell* limestone mine of the *Warner Company*, Bellefonte Division, Bellefonte, Pennsylvania, for working 277,540 manhours without a disabling injury in the nonmetallic underground group. The *Embarrass* iron ore mine of *Pickands Mather* won the award in the open-pit group for working 505,932 manhours without a disabling injury.

M. A. Hanna Company's new circular shaft is being sunk at a rate of about eight feet (of completed shaft) per day at its project in the Minerals Hill area of Michigan. The company is erecting a new surface plant too. Both are to serve the *Homer* and *Wauseca* underground iron mines, replacing existing facilities which will become inadequate as mining goes deeper. The new shaft will be 2,000 feet deep and will be ready for production in 1960.

Pittsburgh Pacific Company of Hibbing, Minnesota has taken over the operations of *Zontelli Brothers, Inc.* Zontelli operations include mines on the Cuyuna Range in Minnesota plus some holdings on the Michigan ranges. The personnel at all Zontelli's operations will remain unchanged and the new company will be known as *Pittsburgh Pacific Company*, Zontelli Brothers Division.

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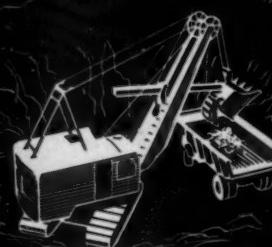


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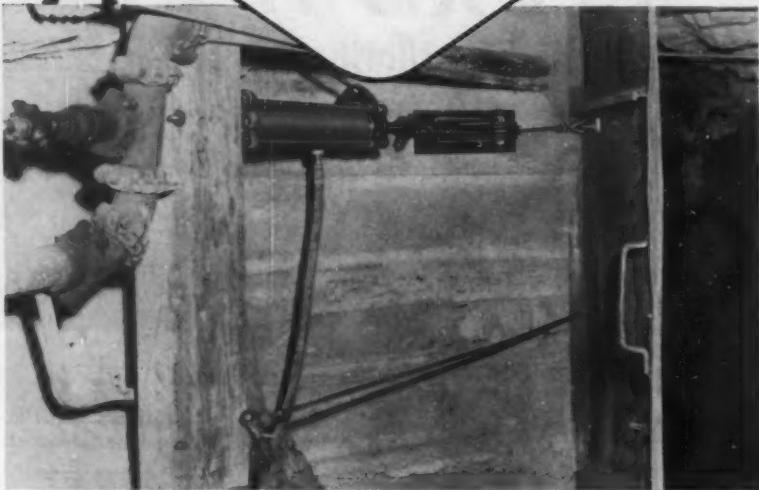
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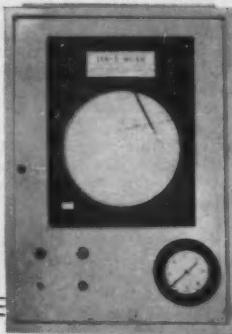
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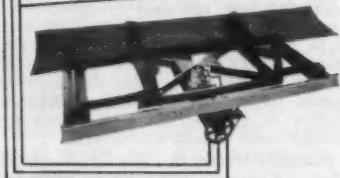
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Northwest Mining Group Meets December 6 and 7

The 63rd annual convention of the Northwest Mining Association is scheduled for December 6 and 7 at the Davenport Hotel in Spokane, Washington. Special feature of this year's convention is a session on Alaskan mining set for Friday afternoon with Philip Holdsworth, Alaskan Commissioner of Mines, as the principal speaker.

Other topics to be covered are "Government Policy and the State of Industry" on Friday morning, and Canadian and physical metallurgy to be covered Saturday morning. A session on geology and milling will complete the program Saturday afternoon.

Washington Governor Mike Stepovich has been invited to speak at the opening day luncheon. Other guest speakers include Edward Wozley, director of the Bureau of Land Management, and C. W. Schwab, chairman of the Emergency Lead-Zinc Committee. William D. Nesbitt will act as general chairman; A. E. Weissenborn as program chairman; and members of the finance committee are E. K. Barnes, Frank N. Marr, and David E. Watson.



A new type of uranium processing plant is under consideration by *Golden Ridge Uranium Company* for construction 110 miles north of Pocatello, Idaho, to treat carnotite ore from the west slope of the Bitterroot Mountains. C. M. Pratt of Salt Lake City is president; A. A. Merrill, Idaho Falls, secretary-treasurer.

A strike of high-grade silver ore has been made in the *Iron Mask* mine in the Talache mining district of Bonner County, Idaho. George Watt, Robert Evans, and Gerald Sarff found the ore in a vein half a mile west of and parallel to the old Talache mine vein which yielded more than \$2,000,000 worth of the metal many years ago. *Iron Mask Mining Company* of Sandpoint has been organized to develop the find. An access road has been constructed to a site for a new adit, from where a crosscut will be driven to intersect the structure several hundred feet below the high-grade discovery. Donald Kotschevar, Sandpoint, is geologist and mining engineer.

Deepening of the *Conjecture* silver mine, Lakeview area, Bonner County, Idaho, from the 500-foot point to the 700 has been completed by *Federal Uranium Corporation*. If known ore bodies extend to the greater depth as expected, management plans to enlarge a small concentrator now at the property.

H. & M. Dredging Company has been organized to dredge for rare metals in black sands on Crooked River near Elk City, Idaho. The firm plans to rework ground dredged for gold in the last few years by *Clearwater Dredging Company*. Vernon B. Finch of Spokane, who owned the Clearwater firm, recently sold his dredge to H. M. McKibben of Twin Falls who heads the new concern. Mr. McKibben plans to rebuild the dredge and substitute classifiers for the present riffles. The state land board last year re-

voked Mr. Finch's gold-dredging permit on grounds it unduly muddied the river water but Mr. Finch appealed to the state supreme court and continued operations. The court recently reversed the land board but Mr. Finch already had completed his dredging operation and sold his dredge to Mr. McKibben.

Black Bear Silver-Lead Mines Company has let a contract for reopening its Canyon Creek adit north of Wallace, Shoshone County, Idaho, an additional 800 feet to the east of present workings. About 100 feet of tunnel will be driven around a caved area. Easterly drifting there would be undertaken toward an ore exposure made recently by diamond drill in the *Erin* claim leased from *Coeur d'Alene Syndicate*. George F. Ringel is manager. *Metropolitan Mines Corporation* of Wallace, which has been financing Black Bear development, is planning a public stock offering.

Lucky Friday Silver-Lead Mines Company millheads have been running about 15 percent lead and 30 ounces of silver per ton, with less than 1 percent zinc. Production is about 125 tons daily. The mine is east of Mullan, Shoshone County, Idaho.

Morning mine lead-zinc ore is being concentrated in the Colconda custom mill pending a decision of *American Smelting and Refining Company* on rebuilding the *Morning* mill which was destroyed by fire last May. The mine is at Mullan, Shoshone County, Idaho. All production is from the Noonday ore body discovered on the 1,250-foot level nearly a year ago. The vein has responded well to development, giving the old *Morning* mine a new lease on life following the working out of the big *Morning* vein.

A four-man General Services Administration survey team recently visited Latah County, Idaho, in connection with possible establishment of a mica-beryl procurement depot there. *Western Mica Association* urged the establishment. The only one in western United States now is at Custer, South Dakota.

At the *Galena* mine west of Wallace, Shoshone County, Idaho, work was started recently on an inclined winze from the 3,400-foot level to open a new level at a depth of 4,000 feet. The operating firm, *American Smelting and Refining Company*, is using a Cryderman shaft mucker. The winze is in a strong silver-copper vein. Mine production has been about 375 tons of ore daily.

A new ore shoot has been opened in the *Silver Summit* mine, Coeur d'Alene mining district, Shoshone County, Idaho, by *Polaris Mining Company*. It was found by tunneling westerly from a raise put up from the 2,800-foot level and, at last report, had been opened for a strike length of 270 feet. Polaris is raising on silver-copper ore in the Rainbow area, which is under development from the 3,000-foot level of the *Silver Summit* mine; the firm also is continuing an exploration lateral easterly through the ground of *Rainbow Mining and Milling Company*.

Difficult ground conditions have been experienced by crews driving east and west laterals at a depth of 2,000 feet in the *Silver Mountain Mining Company* property east of Mullan, Shoshone County, Idaho. The main exploration crosscut had been advanced 2,000 feet northerly, at last report. *Hecla Mining Company of Wallace* is doing the work with aid of the *Bunker Hill Company* and the *Defense Minerals Exploration Administration*.

Idaho Custer Silver-Lead Mines has passed the half way point in a planned 250-foot extension of the shaft at its *Livingston* mine near Clayton, Custer County, Idaho. A heavy water flow impeded progress. The work is being done by *Hecla Mining Company*, Wallace, under an option to acquire a 60 percent interest in the property. The present work, however, is being financed by Idaho Custer, with DMEA assistance.

Capitol Uranium has obtained an option to buy 15 claims near Blackbird, Idaho. The property is near that of *Howe*



Handling Hot Slag at Idaho Phosphate Plant

A steaming cargo of hot slag is pictured above, as it is dumped onto slag dump at the *Monsanto Chemical Company*'s operations at Soda Springs, Idaho. The slag from electric furnaces of phosphate rock is run into the pits at a temperature of 2,500° F., then quenched with water sprays to solidify it. The slag is then loaded into haulers and transported to the waste dump. More than 50 tank cars of elemental phosphorus are shipped by *Monsanto* each month, producing approximately 30,000 tons of slag. The hauler pictured above is a LeTourneau-Westinghouse D rear dump.

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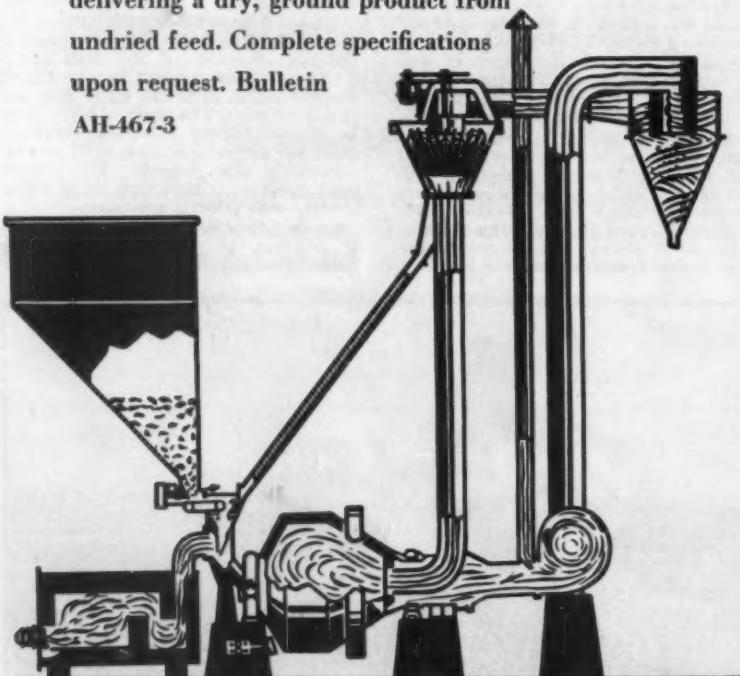
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NORTHWEST

Sound Company's cobalt operations, and the optioned property is said to be a potential cobalt producer, too.

Gypsum production has been started at the mouth of Rock Creek in Washington County, Idaho by Rock Island Gypsum Company. Kenneth Steck of Weiser is president.

Nevada Copper Company of Boise, Idaho has been incorporated with \$2,000,000 capital stock by Rudolph L. Gross, Portland, Oregon, and James H. Hawley Jr. and Ruth Bayhouse, both Boise.

MONTANA

A possible iron ore property has been acquired by Eastern Star Mining Company east of Mullan, Idaho, near the Idaho-Montana border. There are 14 claims in the group which adjoins the holdings of Uranium Mines, Inc. on the southeast, and is about three miles east of the Silver Mountain group now being explored by Hecla Mining Company and Bunker Hill Company. A sizeable iron outcropping has been exposed.

Minerals Engineering Company suspended tungsten mining operations in Beaverhead County, Montana, because of falling tungsten prices resulting from dumping of foreign tungsten in the United States market. The firm's Montana operations had been a major source of domestic production since 1951.

Garrison Mines has a small crew working at the Silver Hill gold-silver property at Virginia City, Madison County, Montana.

Northern Mining and Milling Company resumed operations recently at the Hawkeye mine near Landusky, Phillips County, Montana.

R. R. Hardgrove of Livingston, P. G. Gilfeather of Great Falls, and R. E. Krause of White Sulphur Springs, have incorporated Camas Creek Mining Company of Great Falls, Montana, with capitalization of \$50,000.

Montana Iron Mining Company has started operations at its property about 18 miles from Stanford, Montana. Iron ore shipments are already being made from the Willow Creek mine of Young-Montana Corporation at Stanford.

The Treasurer State Uranium Company is reopening the Brooklyn mine located about six miles east of Maxville, Montana. A novel system of underground mining is to be instituted. The large low-grade vein, of a decomposed igneous dike nature, is to be minded with a hydraulic giant; the mined material is to be transported through a six-inch pipe line as a slurry to a mill located about one mile away. If this system proves successful, it will be quite an innovation in the mining industry.

The Hecla Mining Company will explore and develop a group of claims held by Montana Standard Mining Company Ltd., under terms of an agreement recently negotiated between the two. The contract gives Hecla a 50-percent interest in any ore found on the property and also an option to purchase the entire property on or before January 1, 1961. Development work is to be started within nine months. The property consists of nine

NORTHWEST

patented and one unpatented claims located on Prospect Creek, about 12 miles west of Thompson Falls, Montana. Recent work in the mine exposed some good lead-silver-zinc ore above the adit level.



Harvey Aluminum Company's new \$65,000,000 aluminum reduction plant at The Dalles, Oregon is scheduled to be in partial operation by early next year. It will have a planned capacity rate of 108,000,000 pounds annually, and will treat 100,000 tons of alumina annually from Japan.

The Nickel Corporation of America reportedly has plans for construction of a plant in the Illinois River Valley, north of Cave Junction, Oregon, with a capacity of 30,000,000 pounds of nickel annually. However, it must first obtain a contract for sale of no less than five years' output. Since the firm could not start producing until 1959, and since International Nickel Company expects to alleviate the present nickel shortage by 1960, the only alternative is for the Nickel Corporation to find foreign buyers. Exports of nickel are presently banned because of the domestic shortage but controls might be lifted by 1959.

The Thunderbird Mining Corporation of Medford, Oregon has reopened the Cynthia chrome mine in Josephine County. First shipments have already been made to the Grants Pass purchase depot. About 100 tons assayed from 46 to 48 percent Cr₂O₃. Frank Grover, Nate Smith, and E. C. Brittsan are the organizers of the mining firm. The mine is located at an elevation of 5,000 feet, in the Whiskey Peak area.



Geo-Resource Corporation reports that it has made a uranium discovery on property adjacent to its DMEA exploration project on Washington's Blue Mountain (Sec. 15, T. 29 N., R. 38 E.). The successful use of geochemistry to locate the subsurface uranium is credited with the find. Company geologists report the mineralization was discovered in a laminated schist several hundred feet from the nearest granite contact. It occurs as fracture fillings and coatings of autunite in a strong continuous system of northwest trending fractures.

Clayloon Uranium Company is mining high-grade autunite veinlets and doing exploratory drilling at the Huffman lease in the Mount Spokane district, Spokane County, Washington. The work is under an operating agreement with *Daybreak Uranium, Inc.*, which has shipped nine carloads of autunite ore to a Salt Lake City processing plant. Future shipments will go to the new Ford, Washington plant. J. Van Gundy of Spokane is con-

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1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher—Wm. B. Freeman, 500 Howard Street, San Francisco 5, California; Editor—George O. Argall, Jr., 500 Howard Street, San Francisco 5, California; Managing Editor—None; Business Manager—Max F. Holsinger, 500 Howard Street, San Francisco 5, California.

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WM. B. FREEMAN, President (Publisher)

Sworn to and subscribed before me this 1st day of October, 1957.

(SEAL)

Barbara M. Hampson, Notary of the Public
San Francisco, California

My commission expires February 18, 1958.

NORTHWEST

sulting geologist; Frank Wilson, Spokane, mine superintendent; and Byrl T. Goodwin, Spokane, president.

North Star Uranium, Inc. recently made initial truck shipments of autunite-bearing ore to the new Ford, Washington uranium processing plant. Production is from the firm's Lehmbecker lease in the Mount Spokane district. Exploration work at the property now is being done by *Daybreak Uranium, Inc.* on a contract basis. North Star also has been exploring its Kessler lease in the same district. A. C. Townsend of Spokane, is secretary.

A. G. Lotze of Colville, Washington has started exploring and developing the old *Electric Point* mine on Gladstone mountain, northern Stevens County, under a lease from *Northwest Mining Syndicate* of Spokane. High-grade lead ore is being stockpiled from a newly uncovered "chimney" in limestone and a shaft is being sunk. Lotze has been making shipments of high-grade from the adjoining *Gladstone Mountain Mining and Milling Company* property, which he also holds under lease. Fred M. Viles, Spokane, is managing director of Northwest Mining Syndicate.

Utahcan, Inc. has leased 820 acres in the Jim Creek area of Pend Oreille County, Washington from lone prospectors, George and Henry Rushmier, and is planning open-pit mining of lead-zinc-silver veins uncovered by stripping and trenching. Gordon Berkhaug, Spokane, is vice president in charge of operations.

Goldfield Consolidated Mines Co. of Reno, Nevada has been doing exploratory diamond drilling about 2,000 feet east of its *Anderson* open-pit mine in the Northport mining district, Stevens County, Washington. The mine has been closed several years because of low prices for zinc. *Boyles Brothers Drilling Company* of Spokane was doing the work under contract. T. Higginbotham is residence manager for the firm.

Daybreak Uranium, Inc. is shipping about 1,000 tons of uranium ore monthly to *Dawn Mining Company's* new \$8,000,000 uranium processing plant at Ford, Stevens County, Washington. Ore is trucked about 40 miles from Daybreak's *Dahl* lease open-pit mine in the Mount Spokane district, Spokane County. Daybreak has stockpiled more than 5,000 tons of autunite with an estimated minimum value of \$100,000. Merle Wellman of Spokane has been using two 20-ton and one 12-ton truck trailers to haul the ore under contract.

Dawn Mining Company now is accepting uranium ore from other Northwest producers for processing in its new \$8,000,000 plant at Ford, southern Stevens County, Washington. The 400-ton-per-day plant will accept up to 100 tons daily on a custom basis. The bulk of ore handled is coming from the firm's *Midnite* mine in the adjacent Spokane Indian Reservation. The mill is being operated seven days a week. The crusher, which has a capacity of 500 tons of ore daily, is on a six-day operational basis. The full operation employs about 55 men. The *Bunker Hill Company* has contracted to supply the sulphuric acid requirements of the plant. The acid is a by-product of Bunker Hill's electrolytic zinc plant. Dawn Mining is 51 percent owned by *Newmont Mining Corporation* and 49 percent owned by *Midnite Mines, Inc.* of Wellpinit. R. B. Fulton, is general manager.



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U.S. Manganese Corporation is proceeding with drilling of claims in the Picayne Basin near Silverton, Colorado to test the depth of rhodonite ore bodies. The work is being done by *Boyles Brothers* of Salt Lake City. Results of tests of rhodonite from the Silverton area have not been announced yet. An experimental plant at East Orange, New Jersey has been treating a test shipment of concentrate using a new process developed for extraction on manganese from rhodonite. *Vitro Corporation of America*, developer of the process, and *Great Divide Mining and Milling Corporation* formed U.S. Manganese last year. Lawrence Martin is resident manager of the firm in Silverton.

The *Westminster Corporation* has purchased the leases of 12 mining claims in the Slick Rock mining district of Montrose County, Colorado from the *Fritz-Erickson Mining Company* of Dove Creek. The property is in the southern end of the Uravan Mineral Belt, and three ore horizons have been located on the claims. Development is underway with an incline adit being driven into the larger body.

Among the contracts recently approved by the DMEA are the following: *Strategic Minerals Exploration*, \$13,500 to explore for uranium in San Juan County, Utah and Montrose County, Colorado; Arthur A. Cervi, \$17,536 to explore for uranium in Jefferson County, Colorado; *D & J Uranium & Exploration*, \$44,800 to explore for uranium in Saguache County, Colorado.

Additional mineralized beds and ore bodies have been discovered by *United Western Minerals Company* crews working in the Sangre de Cristo Mountains in Colorado. Three large crews, previously held up by the weather, are now actively engaged in the exploration and development program. All of the area has been photographed, aerially surveyed, and a geophysical study of the area has started. Ore bodies and mineralized beds are being flagged. In the Tallahassee area, United Western has acquired 5,000 additional acres of properties on options and leases and has staked approximately eight sections of federal mining claims. Pilot mill samples of the ore have been taken by the *Dow Chemical Company* and is now being tested. Ore has also been shipped to the AEC in Grand Junction. All tests have proved satisfactory regarding the metallurgical tests for processing U_3O_8 .

SOUTH DAKOTA

The *Ohio Oil Company* and *Arthur E. Pew* have decided to postpone building of a mill to extract uranium concentrate from lignite occurring in the western parts of North and South Dakota "pending development of improved ore process-

ing or a greatly increased demand for uranium oxide." They have indicated that, as a result of their process studies, their proposed operation was not economically feasible at the ceiling price of \$10.50 per pound of U_3O_8 contained in acceptable concentrates derived from lignite.



Vitro Uranium Corporation, a division of *Vitro Corporation of America*, has signed a long-term agreement with *Jen, Inc.* of Moab, Utah for the purchase of large quantities of low-lime uranium ore. Under the agreement, Jen will ship uranium ores from four claims in the Big Indian district, known jointly as the *Cord* mine, to *Vitro* mill in Salt Lake City. The agreement extends to March 31, 1962. Jen will provide a maximum 10,000 tons of ore per month during the agreement period, and also has an option to increase shipments to 12,000 tons per month on 30-day notice. *Vitro* has completed a \$2,000,000 expansion program at the Salt Lake plant. The expansion added 110 tons to the daily capacity bringing it to 660 tons per day. Included was a change to the solvent extraction process.

Howe Sound Company will move its executive offices from New York City to Salt Lake City next spring in order to bring the executive group into closer contact with the operating situation in the West. The firm's principal properties are

in the western United States and Mexico.

Four Corners Uranium Corporation of Denver, Colorado, reports very satisfactory results at its operations at Green River, Utah where the firm is working under a DMEA contract. Widespread drilling in Stage 1 discovered at least five potential ore bodies, and closer spaced drilling in Stage 2 is even more promising, says the firm.

New Park Mining Company has shut down operations at its *Mayflower* lead-zinc mine in the Park City district east of Salt Lake City, Utah. The mine had been operating since 1932, producing 6,000 tons of ore monthly. 200 miners were affected by the closure.

WYOMING

Columbia-Geneva Steel Division of the U. S. Steel Corporation is negotiating bids for construction of a proposed iron processing plant, following contractors visits to the plant site about 25 miles south of Lander, Wyoming. Actual construction at the *Atlantic City* project is expected to start about March 1, and to take 2½ years to build. The low-grade ore would be concentrated for shipment to the U.S. Steel plant at Provo, Utah.

Rissler and McMurray of Casper, Wyoming are reported to have started striping the *Vaca* claims in the Gas Hills area of Wyoming for *Vitro Minerals Corporation*. About 350,000 yards of overburden will be removed to reach an ore



Continental Wyoming Largest Crooks Gap Shipper

Continental Uranium Company of Wyoming is now the largest uranium ore producer in Wyoming's Crooks Gap district. First shipment of ore from the Siesmic open pit pictured here was made on August 13th to *Western Nuclear Company*'s new mill at Jeffrey City nine miles northeast of the mine. Regular shipments are continuing. This photograph, taken by the "Riverton Ranger," looks southwest. Over the ridge to the top left of the picture *Continental Wyoming* is sinking the two-compartment Siesmic shaft to a depth of 250 feet. This shaft is to mine what is believed to be the down dip extension of the ore zone being mined in the pit. Drill holes near the shaft have cut as many as five mineable ore horizons. *Continental Wyoming* is a wholly owned subsidiary of *Continental Materials Corporation* which has important uranium operations in Colorado, and the *Continental* and *Rattlesnake* mines in Utah's Big Indian district. Jim Turnhand is superintendent for the Wyoming operations. *Phelps Dodge Corporation-Wyoming Uranium Company* ground adjoins the open pit to the left. The geology of the Crooks Gap district is described in detail by Charles Melby in an article in this issue of *MINING WORLD*.

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ROCKY MOUNTAIN

body 44 to 71 feet deep. At present, Vitro Minerals is shipping 10,000 tons of uranium ore each month to the *Western Nuclear Corporation* mill at Jeffrey City and to Vitro's Salt Lake City mill.

Allen D. Gray, executive vice president of *Fremont Minerals, Inc.*, announces that his company is in "technical agreement" with the U.S. Atomic Energy Commission as to terms and conditions of a contract covering construction and operation of a uranium ore processing mill at Riverton.

Cunac Minerals, Inc. has been awarded a \$20,760 contract by the DMEA for exploration for thorium in Fremont County, Wyoming. *Metals, Inc.*, under a \$31,732 contract, is seeking uranium and selenium in Natrona County, and *Modern Mines Development* has a \$40,870 contract to explore for uranium in Big Horn County.

Shoni Uranium Corporation, holding major properties in the East Gas Hills area, has acquired additional claims in the recently-discovered Shirley Basin area in south central Wyoming, where 7,000 feet of drilling has already been accomplished, and at the head of Conant Creek on the Beaver Rim in Fremont County where there are 58 claims formerly held by *Cheyenne Mining and Uranium Company*. The latter firm shipped almost 2,000 tons of ore from the mine opened on the claims in 1955.

Ormsbee Drilling Company of Boulder, Colorado began drilling in mid-September under a sub-contract from P-C *Mining Corporation* which received an \$81,200 Defense Minerals Exploration Administration contract to explore holdings in the East Gas Hills. About 75,000 feet of hole will be drilled. N. P. Juneman, who recently completed a DMEA program for *Antelope Mines*, is assisting in handling the P-C Mining Corporation contract. John Cummings, vice president in charge of operations for P-C Mining, said that his firm has acquired the 27 claims in the *Shawer* group which adjoin the present *Thunderbird* group of claims on the west.

N. P. Juneman, part owner and manager of the *Antelope Mines*, announced that *Gas Hills Uranium Company* has been granted an option to buy Antelope Mines Gas Hills property which involves 21 claims. Cotter Ferguson is president of Gas Hills Uranium Company.

Kerr-McGee Oil Industries, Inc., is conducting a deep drilling program on a group of 350 claims in northeastern Carbon County, Wyoming. About 17,000 feet of shallow drilling were completed first, and current drilling will go as deep as 400 feet. It has been reported, too, that *Tidewater Associated Oil Company* is doing some drilling in the same area.

Pacific Power & Light Company is exercising options obtained last fall for a 30-mile power line which will lead from Lander, Wyoming to the South Pass area, and the big iron ore deposits which *Columbia-Geneva Steel Division of United States Steel Corporation* is presently evaluating near the ghost gold mining town of Atlantic City.

Fees for uranium prospecting permits on the Wind River Indian Reservation in Wyoming were reduced from \$200 to \$25 in an announcement by Acting Superintendent C. E. Faulkner. The entire reservation area, except for the Wilderness region, has been opened to prospecting for the first time.

INTERNATIONAL NEWS

Japan Extends Search for Mineral Resources To Asia, Middle and Far East, Latin America

In a widespread search for mineral resources to supplement her own depleted supply, Japan is planning to organize an Overseas Underground Resources Development Association to send survey teams to Iran, Pakistan, Peru, Chile, Indonesia, New Caledonia, and British Borneo. Groups of two to five experts, backed by the Japanese government, will conduct explorations in the hope of developing iron, copper, lead, chrome, nickel, manganese, and bauxite resources in these countries.

Private Japanese firms have been expanding operations in foreign countries since 1951. Five joint mining companies have been formed and over \$5,000,000 has been invested to develop underground resources abroad.

Two of these joint companies are in Thailand. The Mitsubishi Metal Mining Company joined with G. H. Chua to establish the New Cheang Pra Company to develop the Cheang Pra tin mine. The Mitsui-Yip Mining Company was formed by Mitsui Mining & Smelting Company and Yip In Tsoi & Company to develop tungsten deposits in the southern part of the country. In addition, future development of the Mae Sod zinc-lead mine in northern Thailand is planned by a joint company formed by Sumitomo Metal Mining Company and the U Ton Thai Company.

In Malaya the Temangan Iron Mining Company and the Endau Iron Mining Company were established by the Nippon Mining Company and the Kokan Mining Company to develop iron ore deposits. Production at the Endau mine began

recently with an estimated production of 180,000 tons of ore annually.

In Mexico the Dowa Mining Company formed the Dowa de Mexico S. A., a joint company to develop a copper mine in that country. Monthly production is expected to reach 2,500 tons of crude ore by April 1959.

Japanese investments, in the form of loans and technical assistance in exchange for mineral resources, center mainly in the Philippines. Approximately 1,200,000 tons of iron ore will be shipped annually to Japan from the Philippine Iron Mining Company following completion of new facilities at the Larap iron mine. An additional 5,000 tons of ore a month is expected from the Palawan iron mine of the Bacumgan Iron Mining Company beginning in 1958. In exchange for \$1,000,000 invested in Atlas Consolidated Mining & Development Corporation's Toledo copper mine, approximately 10,000 tons of copper concentrate is shipped to Japan each month.

Japanese interests have extended as far as South America where exploration near Copiapo, Chile indicates an estimated deposit of 25,000,000 tons of iron ore in one of the three mines located in the area. A joint company formed with Chile is planned by Mitsubishi Mining Company and the Mitsubishi Trading Company.

In Burma the Matsuo Mining Company is conducting a survey for antimony mines in the hope of establishing a joint venture there. Surveys are also being carried on in the Sibuguey mine in Mindanao and around central Luzon by separate Japanese groups.

is not nor has it been a uranium producer. The Aerofall test unit was operated for gold ores only at Daggafontein. The uranium results were indicated by testing ores from other South African mines.

MINING WORLD regrets this error in summarizing test work done in the Union of South Africa.



NORTH AMERICA

LABRADOR—Canadian Javelin Ltd. has made a new iron ore discovery about 35 miles west of Wabush Lake, on property it retained in a recent agreement with *Pickands Mather & Co.* and the *Steel Company of Canada Ltd.* The latter firms formed *Wabush Iron Company* to develop a 4,700-square-mile concession which Canadian Javelin holds from the *Newfoundland and Labrador Corporation*. The new discovery has been named the *Jubilee* iron deposit and will be developed by a newly formed Javelin subsidiary, *Jubilee Iron Corporation Ltd.*

BRITISH COLUMBIA — Kennecott Copper Corporation's Canadian subsidiary, Northwestern Explorations Ltd. has an option to develop property in the Highland Valley held by *Krain Copper Ltd.* The option expires on March 1, 1964. During the first 18 months of the option, Kennecott is to spend \$100,000 on the copper prospect. If it is decided to proceed with development beyond the expiration date, a new company will be formed in which Northwestern will hold 60 percent of the stock and Krain Copper 40 percent. Krain is owned by *Beaver Lodge Uranium Mines Ltd.* and *Farwest Tungsten Copper Mines Ltd.*

ALASKA — The Wolf Creek Mining Company has taken over the *Fish Creek* property owned by the *U.S. Smelting, Refining and Mining Company*. Equipment has been moved from Wolf Creek, 25 miles up the Steese Highway from Fairbanks, to Fish Creek. Manny Olson and Andrew Anderson, operators of the company, have signed a long-term lease and have been stripping and placing a drain in the property before winter shuts down further operations. Even during the dry season, the creek is large enough to supply ample water. Only preparatory work will be done next year, with mining to follow a year later. During the 1930's, the ground was worked by the *Fairbanks Gold Dredging Company*, financed by English capital. U.S. Smelting acquired the property just before World War II and operated for two seasons. The property was shut down by war order L-208. Covered in the lease are two miles of ground on Fish Creek and its tributaries, Pearl and Last Chance.

QUEBEC—Carey-Canadian Mines Ltd. expects its new 2,400-ton-per-day asbestos mill to go into operation on January 1, 1958. Ore will come from a series of newly developed asbestos deposits on the northeast extension of the Pennington dike structure, where 50,000,000 tons has been indicated. Some 1,250,000 cubic yards of overburden have been removed and the pit is ready for actual mining. Carey-Canadian is a wholly owned subsidiary of *Philip Carey Manufacturing Company* of Cincinnati, Ohio.

Newmont and Atlas Plan Philippine Expansion

Newmont Mining Corporation of New York has signed an agreement with the Atlas Consolidated Mining and Development Corporation, in the Philippines, to develop additional ore reserves at Atlas's Toledo copper mine on Cebu Island. According to the contract, Newmont will expand the present blocked out reserves at its own expense, and search for new deposits in the same vicinity. Newmont will use its own geophysical techniques and equipment and will receive one block share at Atlas stock for every \$22.85 invested in the project.

Newmont will also do exploration work in areas outside of the Toledo mine and if reserves of 5,000,000 tons or more of copper ore suitable for open-pit mining are found, it will receive 1,250 block shares of Atlas stock for every 100,000 tons of proven ore.

It is estimated that a total of 262,500 block shares (2,265,000 ordinary shares) will be received by Newmont when the contract is terminated. As of October 10, this stock is worth \$3,510,000.

Present production at the Toledo mine is 12,000 tons a day. Recent production figures for the period from January to August show an increase of 51 percent in copper and 40 percent in gold over production during the same period last year, with 2,251,413 pounds of copper and 6,644 ounces of gold produced in 1957. Net profits for the first six months of 1957 amounted to 1,788,533 Philippine pesos.

Income from sales for the period was 11,151,509 Philippine pesos.

Atlas is now completing its acid and fertilizer plant at Lutopan, Toledo which will be ready for operation during the first half of 1958. Atlas also owns 35 percent of the capital stock of the Phelps Dodge Copper Products Corporation of the Philippines whose plant for the manufacture of electrical copper wire and cable is also scheduled to begin operating early next year. Atlas officials have recommended that a separate corporation be formed for the acid and fertilizer plant because of the importance and specialized nature of the project. Atlas will own 40 percent of the new corporation.

At the suggestion of Newmont Mining Corporation, an American flotation expert spent several weeks in the Philippines recently, visiting processing plants and observing ways and means of increasing production.

East Daggafontein Is Not A Uranium Producer

A misstatement on page 34 of the 1957 Catalogue Survey and Directory number of MINING WORLD has been brought to the Editor's attention. The statement appeared in a review of metallurgical trends and developments and incorrectly quoted an earlier MINING WORLD article. East Daggafontein Mines Ltd., Union of South Africa, was credited as having increased gold recovery as much as 4.2 percent and U_3O_8 recovery by 9.5 percent by the use of Aerofall grinding. East Daggafontein

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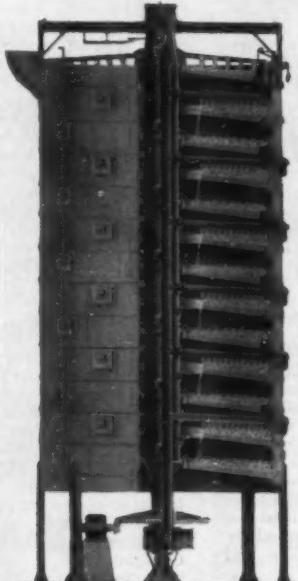
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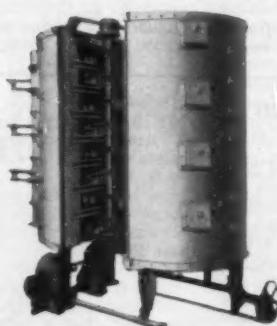
SIZES 8' 6" TO 22' 3" DIAMETER
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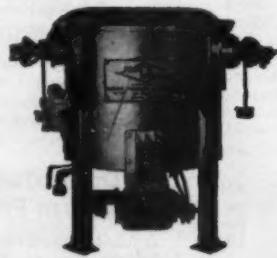
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MINING WORLD

ONTARIO—Pronto Uranium Mines is deepening its 591-foot shaft to about 1,000 feet in order to make room for two more levels. Present levels are at 111, 207, 283, 372, and 462 feet, with mining so far being carried on only at the top three levels. The fourth level has been prepared for development, and the fifth will be started soon. The mill is handling about 1,500 tons per day.

BRITISH COLUMBIA—Western Exploration Company Ltd. is undertaking a \$250,000 deep development program at its *Mammoth*, *Monarch*, and *Hecla* silver-lead-zinc mines at Silverton, in the Slocan mining district. Road construction has started to connect with a portal site for a new main haulage tunnel which will be 2,500 feet long. It is hoped to intersect the Mammoth ore zone at a depth of 400 feet vertically below the present No. 9 or bottom level. Two supplementary sub-levels will also be driven. The firm's concentrator, with a monthly capacity of 3,600 tons, is expected to treat custom ore and also about 2,000 tons monthly from the company's own mining operations.

MANITOBA—Delhart Minerals Corporation reports it has found beryl in "interesting quantities" at Greer Lake, about 100 miles north of Winnipeg. The company has 134 claims covering about 7,000 acres in the area. Ore samples are being stockpiled, pending analysis of the mineral.

ONTARIO—Stanleigh Uranium Mining Corporation expects to have its milling operations underway this month. The 3,000-ton plant will be brought to full

production gradually. Development ore is being stockpiled from the No. 1 shaft which is 3,790 feet deep. The No. 2 service shaft has just been completed to a depth of 3,690 feet. Lateral work is underway.

MANITOBA—Montgary Exploration Ltd. has about completed sinking of its three-compartment shaft at its *Bernic Lake* lithium property pending a decision from *American Metal Company*. The latter has an option which expires this month, so further development of the property and building of a mill have been suspended. Meanwhile, Montgary is experimenting to determine whether it would be feasible to install an Aerofall mill to cut down crushing costs.

ONTARIO—Greyhawk Uranium Mines is shipping 300 tons of uranium ore daily to the Faraday mill. The company's property is in the Bancroft area. Shipping ore comes from prepared stopes on each of the three mine levels. It is expected that several months will be required before an average grade of shipping ore can be determined.

ALASKA—Southeastern Mining & Exploration Company, which holds a uranium property near William Henry Bay on Lynn Canal in southeastern Alaska, has been drilling this season with the assistance of a DMEA loan.

QUEBEC—Asarco Nickel Company, a subsidiary of *American Smelting and Refining Company*, has obtained a good showing of nickel-copper ore in the small number of holes drilled to date at its property in the Ungava area. The company reports that only a large deposit of

good grade would make it practical to undertake production. *American Smelting* has a 63 percent in Asarco Nickel. The concession under exploration covers a 400-square mile area, about 1,000 miles north of Quebec City.

SASKATCHEWAN — The proposed potash operation of *International Mineral & Chemical Corporation (Canada) Ltd.* at Esterhazy (see *MINING WORLD*, July 1957, page 97) will now represent an investment of more than \$20,000,000. Currently underway is sinking of a 3,000-foot circular shaft at a cost of about \$4,000,000. Mining equipment, a refinery, storage buildings, machine shop, and other facilities will cost the remaining amount. The new plant is expected to be the most modern and efficient in the world, according to Louis Ware, president.



AFRICA

TANGANYIKA—Western Rift Exploration Company Ltd. has been formed by *Anglo American Corporation of South Africa*, the *British South Africa Company*, *Tanganyika Concessions Ltd.*, and *Newmont Mining Corporation* for mineral exploration in Tanganyika. Among the assets of the new firm are the exclusive prospecting license acquired from the



New Producer and Expanded Mine Boost Canada's U₃O₈ Production

Canada's uranium production has increased considerably with the opening of *Consolidated Denison Mines, Ltd.*'s operation (pictured at left) and the expansion of *Lake Cinch Mines* (right). The world's largest uranium operation came into production with the official opening of *Consolidated Denison*'s property at Quirke Lake, Ontario, Canada. The ore body, located in the Blind River district, is estimated to contain a minimum of 136,787,400 tons of ore assaying 0.139 percent uranium (2.78 pounds per ton). At current prices the deposit is valued at approximately \$4,000,000,000 and should last for more than 60 years with a production rate of 6,000 tons per day. The ore body is 2½ miles long and about 1½ miles wide. Commercial operations began in June this year when the mill was sufficiently completed to produce about 2,000 tons daily. Since then, production has increased to 4,000 tons daily and, by the end of the year, production is expected to reach 6,000 tons per day. Mining is done through two shafts about 2,500 feet apart. The number one shaft is 1,856 feet deep and number two shaft is approximately 2,600 feet deep. Pictured above is the concentrator building with the 85-foot-diameter thickeners and the boiler house to the right.

Consolidated Denison has agreed to supply \$201,895,000 worth of uranium concentrates to the Canadian government by March 31, 1963. Deliveries have already started and the contract is expected to be fulfilled well in advance of 1963. Uranium production at *Lake Cinch Mines*, Saskatchewan, Canada, has been doubled as a result of the recent expansion. Present shipments have increased from 75 tons to 150 tons daily and an additional increase to 200 tons daily is expected in the future. Mining is done from two levels, at 300 feet and 500 feet, and shaft deepening for two additional levels, 625 feet and 750 feet, is underway. Installation of skip hoisting in place of caging cars and the addition of a 75-horsepower motor on the hoist increased mining capacity to 60 tons per hour. Grade of the ore has also been increased from 0.23 to 0.30 percent. Ore is shipped to the Lorado custom mill two miles away and under the present contract, the company will ship ore containing 1,500,000 pounds of uranium, valued at \$15,750,000. At the end of 1956, reserves were estimated at 200,000 tons with 6.48 pounds of uranium per ton. However, with the opening of the new levels the reserve will be greatly increased. *Lake Cinch Mines* is controlled by *Violamex Mines*.

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INTERNATIONAL

Anglo American Prospecting Company (Africa) Ltd. and the right to prospect the concessions area for radioactive minerals (except gold and silver in the Chunya district) and base metals other than iron. The area of operations extends over about 34,000 square miles with the major north-south axis of about 300 miles. It is bounded on the west by Lake Tanganyika and on the south by the Northern Rhodesian border. Field headquarters are at Chunya, which will maintain radio communications with field parties supplied by aircraft. Chunya lies just outside the concession area. One prospecting plane will be equipped with a scintillometer, a magnetometer, and an electromagnetometer; another with a scintillometer only; and a third to deal with emergencies in outlying camps. The area is one of the least explored in central Africa.

MOROCCO—*Compania Espanola del Rif*, operating iron ore mines in the former Spanish Northern Morocco with a production of over 1,000,000 tons annually, is now considering the erection of a low-shaft furnace for the direct treatment of tailings from its washing plant. The washing plant has been in operation for many years, with some 9,000,000 tons of tailings impounded at sea level. It is located on the Mediterranean coast between Villa Nador and Melilla. Coal would have to be imported through Melilla or brought overland from mines in the former French Morocco.

EGYPT—The recently organized Egyptian mining company, *Societe Minière Elba*, has ordered mining equipment from Poland valued at ££50,000. Poland is to supply mining machinery, air drills, and conveyor equipment. The company is mining manganese ore in the area of Wadi Elba near the border of Anglo-Egyptian Sudan, and not far from the Red Sea.

UNION OF SOUTH AFRICA—Colored cement is being used in pre-sinking cementation boreholes in the Orange Free State as a means of indicating the effectiveness of the sealing-off operations.

TANGANYIKA—The value of mineral exports from the territory in the first six months of this year increased to £2,181,488 from the corresponding 1956 figure of £2,058,035. Returns of the more important items were as follows: diamonds, 145,559 carats valued at £1,351,070 in the first half of 1957, 107,654 carats valued at £966,741 in the first half of 1956; gold, 26,823 ounces at £336,133, compared with 32,785 at £408,698; lead concentrate, 5,125 metric tons at £396,000, compared with 7,251 at £586,766; mica sheet, 34.04 long tons at £33,337, compared with 28.81 at £27,296.

BELGIAN CONGO—*Union Minière du Haut Katanga* is reported to be taking steps to cut production costs and spread investments over a wider period because of the declining price of copper. However, the company's production program is not to be affected. Construction of new plants on the Luulu River will be completed as planned, with the first section to be in operation by 1960. The building of a concentrator at Kambove, near Jadotville, will be postponed.

FRENCH EQUATORIAL AFRICA—*Natomas Company* holds a 47.7 percent interest in a joint venture in French Equatorial Africa with the *Pacific Tin Consolidated Corporation*. Objective is the recovery of diamonds from extensive alluvial deposits. An initial exploratory

program is now in progress to determine whether dredgeable gravels exist in the main river system into which many diamond-bearing tributaries feed. Natomas is particularly interested because it provides an opportunity to use some of its idle dredging equipment.

NIGERIA—*Narazata Extended Areas Ltd.* has located two tin deposits on the right and left banks of the Delimi River. Further investigations have shown that wherever the river bed has been reached, large boulders clogging the channel have been exposed with tin-bearing wash between and under them. Apparently, it can now be accepted that the present river channel throughout its length as far as Deriko can be considered as a potential source of tin.

KENYA—Preliminary prospecting by *New Consolidated Gold Fields* has been started as a result of the discovery of chromite and copper near the Marich Pass in the Suk area. To reach the deposits, a seven-mile road is being constructed which, when completed, will reach an altitude of 8,000 feet. The extent or grade of the findings are not yet known, but the company is speculating on the possibility that this deposit may form part of a copper belt. Should this preliminary work result in undertaking of development, the company would have to move the ore some 65 miles to the nearest rail point which is at Kitale.

UNION OF SOUTH AFRICA—Desalting laboratory tests, followed by pilot plant operations, at the *Western Holdings* mine in the Orange Free State have been successful enough for the company to decide to erect a large-scale electrodialysis plant. The plant will be capable of treating more than 2,000,000 gallons daily with a recovery of usable water of about 80 percent, perhaps more. Other water treating plants may be erected in due course.

FEDERATION OF RHODESIA AND NYASALAND—Work has started on the McLaren shaft of *Roan Antelope Copper Mines* in the Luanhsya district of Northern Rhodesia. The new shaft will be about one mile west of the Irwin shaft, the nearest of the present two ore hoisting shafts.

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MINING WORLD



OCEANIA

QUEENSLAND—Australian Oil Exploration N.L. (original purchaser of the *Mary Kathleen* uranium deposit and now part owner with *Rio Tinto*) has reached an agreement with Stanleigh Uranium Mining Corporation of Toronto and New York for the development of the *Anderson Lode* near Cloncurry. A new corporation will be formed, tentatively called the *Austand Uranium Mining Corporation, Ltd.*, in which each will own a 50 percent interest. The Anderson Lode ore is stated to be metallurgically complex and work will need to be done in determining the size of the deposit.

REPUBLIC OF THE PHILIPPINES—*Benguet Exploration Company's* new 50-ton-per-day mill at Baguio City is now in operation at the *Thanksgiving* mine in Mountain province. The property is operated by *Philex Mining Corporation* on a profit-sharing basis. The ore is high-grade gold in massive zinc blend and pyrite which occurs as chimneys and irregular replacements in limestone.

INDONESIA—Within a short time, gold production from the *Tjikotok* gold mines will be on sale on the free market. At the moment, free market gold price is Rupees 72 per gram, almost five times the "official" prices. Annual production from the mines is expected to be 30 kilograms gold and 11,070 kilograms silver. However, profits are not expected until 1960 when rehabilitation will have been completed.

NEW GUINEA—*Australian Gold Development N.L.* reports that samples from Clark's Ridge on Papua range between 12 and 41 dwt.s per ton. At Mount Victor, prospecting samples have shown about 10 dwt.s per ton.

QUEENSLAND—Under a five-year expansion program at *Mt. Isa Mines Ltd.*, a new assay and research laboratory has been completed, a new administration block is nearing completion, and all plant facilities are being extended and modernized so that production can be trebled by 1962.

REPUBLIC OF THE PHILIPPINES—President Garcia has appointed a five-man board to find ways and means of solving some of the major problems threatening the local mining industry. One subject being studied is the effect of a possible reduction of duties and tariffs.

TASMANIA—A deposit of nickel-cobalt ore at Beaconsfield, not far from Bell Bay aluminum works, is in the early stages of prospecting. Secondary silicates of the metals occur in serpentine and testing in the Department of Mines Ore Dressing Laboratory indicates that treatment is "comparatively simple." No reserves are yet developed.

SOUTH AUSTRALIA—The Mines Department is testing the *Talisker* mine near Cape Jervis as a possible source of commercial arsenic. It was first worked as a silver-lead mine about 100 years ago. Some ore recently assayed showed 8 percent lead and 18 percent arsenic.

NEW GUINEA—*New Guinea Gold-fields Ltd.* has an exclusive prospecting

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How HOMESTAKE solved two HAULAGE PROBLEMS

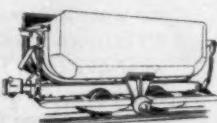
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license over 600 acres on the new *Kainantu* field in the eastern highlands, and expects to start prospecting soon. Mining in the field is alluvial but lode gold is also believed to be present.

REPUBLIC OF THE PHILIPPINES—Test runs are being made in the new 50-ton mill of *Benguet Exploration Company* at Baguio. *Philco Mining Corporation* manages the property for Benguet. The mill is located on the *Thanksgiving* property in Mountain province. The mine has about 20,000 tons of complex sulphide ore developed, assaying about 1.0 ounce gold, 1.5 to 2.0 percent copper, 15 percent zinc, and 0.5 percent lead per ton.

NEW SOUTH WALES—Good production figures continue to be achieved at Broken Hill, New South Wales by the four lead-zinc mines and it cannot be said that any of them are much affected by recent declines in metal prices. The mine at Captain's Flat operated by *Lake George Mines Pty. Ltd.* is very concerned, however, and has no large ore reserves. Anticipated developments in zinc smelting following introduction of *Imperial Smelting Corporation's* new blast furnace process for zinc at Cockle Creek, New South Wales, and later at other points in Australia, promise that there will be great expansion in local industry based on Broken Hill lead-zinc mining. Greatly increased supplies of metallurgical coke will be needed (already in short enough supply) and much more sulphuric acid will become available from the roasting of zinc concentrates formerly sent overseas. Expansion of fertilizer industries must go hand in hand with these developments and helps to explain interest being taken in the search for deposits of phosphate rock within Australia and nearby Pacific Islands such as the Solomons.

TASMANIA—In answer to an inquiry by MINING WORLD's Australian correspondent, the Department of Mines has advised that "the recent airborne magnetometer survey on the west coast of Tasmania indicated very large deposits of iron ore previously recorded over the Savage River and Rocky River and also revealed a previously unknown deposit at Long Plains. Further ground geophysical work has disclosed that the deposits are of very large size and preliminary diamond drilling of the largest deposit will be commenced by the Department during the coming summer season."

NORTHERN TERRITORY—*N. e w Merloo Gold Mines N.L.* (National Lead) at Tennant Creek, will diamond drill the *Queen of Sheba* leases following a favorable geological survey. An option over the *Enterprise* area has been abandoned on the advice of "Mr. Ellett, National Lead's field superintendent."



LATIN AMERICA

CHILE—The International Finance Corporation has agreed to invest \$2,200,000 in *Empresa Minera de Mantos Blancos*, S.A.'s copper mine and smelter project in the Antofagasta region of northern Chile. *Mantos Blancos* is controlled by

Empresas Sudamericanas Consolidadas S.A. of Panama, which holds the extensive mining, industrial, and commercial interests of the *Mauricio Hochschild* group. The Hochschild interests have already invested \$8,000,000 in the *Mantos Blancos* property defining ore bodies and developing a satisfactory metallurgical process. The proved ore body will now be developed and a 2,000-ton per day plant constructed. Full-scale operation is expected by mid-1959 with annual output to be about 25,000,000 pounds of refined copper.

CUBA—The General Services Administration has been authorized to sell the United States government's nickel plant at Nicaro, Cuba, which represents an investment of about \$85,000,000. It is currently operated by the *Nickel Processing Corporation*, most of whose stock is held by *National Lead Company*. Expansion of plant capacity from 30,000,000 pounds to 50,000,000 pounds was completed in March of this year.

MEXICO—Discovery of important fluorite deposits in the State of San Luis Potosi has been confirmed by the Economy Minister. The government department reports that the prospect takes in nine hectares at Guadalupe Victoria. Engineers who surveyed the property say that there are also reserves at Villa Zaragoza.

BRAZIL—The governor of the state of Sao Paulo reports that the French bank of *Lazard Freres et Cie* will arrange for a loan of \$96,000,000 to finance construction of the *COSIPA* (*Companhia Siderurgica Paulista*) steel plant. Brazilian capital

will provide about 2,000,000,000 cruzeiros. The plant is to be built in Pissanguera near Santos, in the state of Sao Paulo, and will have a capacity of 1,000,000 tons annually. First part of the plant is scheduled to go into operation within two years.

DOMINICAN REPUBLIC—*Compania Dominicana de Minerales, C por A*, subsidiary of *Barium Steel Corporation*, has received an extension of the iron ore mining concessions under which it now operates in the Dominican Republic. Originally awarded in 1955, the concession rights have been extended to 1967. The firm has also been granted an exploration permit for the right to explore for iron ore in eight provinces of the country.

MEXICO—An unidentified United States firm is reported to have offered to reopen the abandoned *El Bote* lead-zinc mine in Zacatecas. According to officials of the state government, the company has expressed a willingness to invest \$2,000,000 in draining the flooded shafts and installing modern machinery.

CUBA—*Frederick Snare Overseas Corporation* has received the contract to perform all field work in Cuba for *Freeport Sulphur Company's* \$119,000,000 nickel-cobalt project at Moa Bay. Work is already under way, and completion is called for by July 1, 1959. The contract is with *Moa Bay Mining Company*, a subsidiary of *Cuban American Nickel Company* which, in turn, is a subsidiary of Freeport. Cuban American will conduct the United States part of the project.



Bauxite Ore Loading at Billiton's Open Pit

Yearly bauxite production from N. V. Billiton Maatschappij in Surinam (Netherlands Guiana) is 750,000 tons, making this company one of the world's largest producers of the ore from which aluminum is recovered. Mining is done from an open pit covering an area of 22 square kilometers which lies between 45 and 70 feet below sea level. Water is an ever present problem because of the depth of the pit and the consistency of the overburden, and the use of a large battery of pumps is required to keep the mine in operation. Frequent torrential rains add to the problem, sometimes filling the pit bottom to a depth of two to three feet with muck. Pictured above is ore being loaded onto a LeTourneau-Westinghouse Tourapull rear dump, one of the heavy duty haulers used to carry excavated ore to the crushing and washing mill.

CHILE—The Finance Minister, Eduardo Urzua, is working on a plan which would prevent closing of the small and medium copper mines in the country because of low metal prices. One provision solution is that the Central Bank loan the Mining Credit Bank funds sufficient to enable it to continue paying its usual prices in spite of the world price drop. A long range solution is that the Copper Department buy the entire output of these small and medium producers at fixed prices for resale abroad at prevailing market rates.

MEXICO—*Compania Minera de Sierra de Ramírez*, located at San Juan de Guadalupe, state of Durango, is continuing operations despite the lead-zinc situation. Average production from the mine is about 800 tons per month, averaging 1,500 kilos silver and 5.6 percent lead per ton. The ore is shipped to *Cia Metalurgica de Penoles*' smelter at Torreon.

BRAZIL—*Industria e Comercio de Minérios S.A. (ICOMI)*, which is exploring the manganese deposits at *Amapá*, reports that the 200-kilometer railway under construction for exporting of manganese ore, will also be used eventually to carry iron ore found in the same region.

NICARAGUA—*La Luz Mines Ltd.*'s gold mining project at Siuna is milling 2,000 tons of ore per day. At the *Rosita* copper property, the company is installing a plant which should go into operation in another year.

COLOMBIA—Because of a new 15 percent export tax, the South American

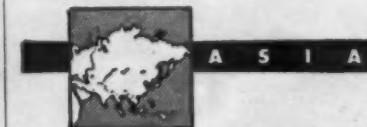
Gold and Platinum Company has not sold any of its gold and platinum there for several months. The bullion is being stockpiled while company and government officials discuss an acceptable solution to the situation. Much of Colombian property was acquired when *Frontino Gold Mines Ltd.* became a wholly owned subsidiary. Production of gold in the first half of 1957 was 74,946 ounces and platinum output totaled 6,659 ounces.

CUBA—Electric smelting tests by the U.S. Bureau of Mines on certain Cuban nickel ores showed that they will yield a low-carbon ferronickel product suitable for use in steel mills. Serpentine and laterite nickel ores from two claims in Cuba were reduced in the Bureau's electric furnace at the Northwest Electro-development Experiment Station at Albany, Oregon on a continuous basis, using bagasse alone and bagasse and coke mixtures as reducing agents. Bagasse, which is the crushed stalks of sugar cane after the juice has been extracted, is available in considerable quantities in Cuba.

HONDURAS—*New York & Honduras Rosario Mining Company* reports that recent deep diamond drilling of the *Nueva* ore body in the *El Mochito* mine indicated a continuation of this ore body to a depth of about 1,425 feet, or 700 feet below the present lowest level of 725 feet.

MEXICO—The firm of *Julio Pani y L. Garcia Robles* has been sold to *Cia Minera y Refinadora Mexicana, S.A.* All of the mining properties are now being developed by the new owners.

JAMAICA—*Kaiser Bauxite Company*, a subsidiary of *Kaiser Aluminum & Chemical Corporation*, is using aluminum railroad gondola cars at its operations at Jamaica. Aluminum was selected as the body material because its lighter weight permits a 20 percent increase in payload. Also, painting is not necessary because the metal resists corrosion even in the tropical marine atmosphere of the island. Manufactured by *Pullman Standard Car Manufacturing Company*, they are the first ever produced in aluminum by Pullman.



PAKISTAN—A UNESCO expert has reported discovery of large deposits of uranium in Hazara district. No details concerning the location have been revealed, but the same report says that tungsten minerals have also been found in the area.

JAPAN—*Toho Zinc Company* has completed expansion of its *Taishyu* smelter in Kyushu and it is now in operation. The new equipment has increased milling capacity from 8,500 metric tons monthly to 10,000 metric tons. Ore will come from a large, high-grade, lead-zinc deposit in the *Taishyu* mine where reserves are estimated at 150,000 tons, part of which contains 44 percent combined lead-zinc in the crude ore. The company has also started operation of a copper refinery at its *Annaka* refinery in *Gumma-ken* where large-scale lead and zinc operations are also carried out. Initially, the refinery will

treat imported blister copper, but, later, ore mined by the company will be treated as well as imported concentrate.

INDIA—The Union government has decided to develop the pyrite deposits at Amjor in Bihar. Reportedly it will be a joint operation between the Union Ministry for Steel, Mines and Fuel, and the Bihar State government. It is expected to eliminate the country's need for importing sulphur which presently totals 17,000 tons of sulphur annually.

TURKEY—A drilling contract has been signed by *Krupp* of Germany and the *Verdi Company* of Istanbul. It provides for drilling operations in the Iskenderun district where bauxite deposits with a high iron content are said to occur.

THAILAND—A new mining law has been drafted by the Thai government which provides for greater governmental control of mineral resources. The Minister of Industries is given the authority to establish a Mining Department Office in any district where there are large mineral resources. The bill provides for the granting of survey permits for areas not exceeding 3,000 rai (1 rai equivalent to 400 square yards) for a period up to one year. Concessions for operation of deposits will be granted for no more than 25 years.

MALAYA—*Oriental Mining Company* has started production at the *Temangan* iron mine in Kelantan. It is expected, initially, to produce about 350,000 tons a year. Shipping will not begin until after the monsoon season, probably next March. Associated with the Oriental Mining Company are *Boustead and Company Ltd.* (with 51 percent), *Kokan Mining Company*, and the Kelantan government. In addition to installation of mining machinery, a rail road had to be built. This operation is expected to bring Malay's total exports of iron ore, principally to Japan, to over 3,000,000 tons a year.

JAPAN—After three years of prospecting, *Sumitomo Metal Mining Company* has discovered promising copper deposits at the *Hakko* mine in *Aomori-ken* and *Uzen* mine in *Yamagata-ken*. Reserves in the *Hakko* mine have been proven to be 300,000 metric tons of copper ore containing an average of 1.5 percent Cu. Reserves in the *Uzen* mine have not been disclosed but the width of the vein is said to be up to 4 meters containing 2.0 percent Cu.

INDIA—The Geological Survey of India and the Indian Bureau of Mines have been asked to do further exploratory work in the diamond deposits near *Panna* before a decision is made about forming a company to work these deposits. The yield is estimated at 12.8 carats per 100 tons. The problem of developing these reserves has been studied successively by the Pichamuthu Committee, two Russian experts, and recently by a United States expert—Mr. Johnson.

JAPAN—After several joint discussions between the Japan Mining Industry Association and the Mining Bureau of the Ministry of International Trade and Industry, both groups agreed to set up a new association called the *Overseas Mineral Resources Development Cooperation Association*. Membership will consist of the presidents of the following companies: *Nippon Mining*, *Mitsubishi Metal Mining*, *Mitsui Mining & Smelting*, *Sumitomo Metal Mining*, *Furukawa Mining*, *Dowa Mining*, *Nittetsu*, *Ishihara*, *Rasa*, *Nomura*, *Toyo* and *Toho Zinc*, who have

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been in connection with overseas mining companies directly or indirectly. The new association, which goes into operation on November 1, will be a service organization working on technical assistance to undeveloped overseas countries in the fields of geological survey, mining, ore dressing and smelting problems in accordance with requests from those countries. A government subsidy amounting to 7,000,000 yen for the remainder of the 1957 fiscal year ending March 31, 1958 was approved.

MALAYA—*Taiping Consolidated Ltd.* has set aside \$1,600,000 to meet the cost of moving the Kundang dredge to the *Taiping* property some time next year. The *Kundang* property is expected to be depleted by the middle of 1958. The *Taiping* property has an estimated life of seven years which is expected to justify the expense involved in transferring the dredge.

TURKEY—An iron ore deposit near Simav in western Turkey is now producing about 100 tons per day. The transportation cost to the harbor at Izmir is a little more than the selling price of iron ore, but a government regulation makes this production worthwhile by permitting exporters of crude iron ore to import products made from iron. Consumer demand for these items is great enough to offset the other loss.

ISRAEL—United States engineers are reported to be studying the economic feasibility of laying a pipeline from the southern end of the Dead Sea either to the Mediterranean coast or to Eilat on the Red Sea to carry export potash directly to the sea. Israel's potash resources are estimated at 200,000,000 to 300,000,000 tons, with monthly output now at 7,200 tons. Efforts are being made to increase this monthly figure to 10,000 or 11,000 tons by the end of 1957.

MALAYA—*Tanjong Tin Dredging Ltd.*'s No. 1 dredge, which had been working partly in virgin ground and partly in previously worked ground, is now entering an area which has not been dredged at all. Results obtained from this new section indicate that a deeper digging unit would be more economical to operate in this ground, so the No. 1 dredge may be closed down, and the No. 2 dredge moved in its place.

PAKISTAN—Gold deposits have been discovered in the Chaghai area of Baluchistan and the Geological Survey of Pakistan is now carrying out bulk sampling and testing operations there. Preliminary tests indicate the deposits might be valued as high as Crores 30 or 40, if the quality of the ore remains the same throughout the area.

TURKEY—The large colemanite deposit ($\text{Ca}_8\text{Be}_2\text{O}_{11} \cdot 5\text{H}_2\text{O}$) found by the MTA Institute in the vicinity of Kuthaya early this year has now proved to contain at least 7,000,000 tons. The discovery was made while prospecting for lignite deposits, and all MTA geologists now mapping for lignite are also seeking borax. It is reported that several private companies have tried to obtain rights to the claims, but the MTA institute is holding onto them.

INDIA—Recent experiments at the U.S. Bureau of Mines' laboratories at Denver, Colorado have showed that raw lignite from a large deposit at South Arcot, Madras, India, can be upgraded by a processing method developed by the Bureau to produce superior fuels for certain

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uses. Pilot-scale tests will be continued in India with a replica of the Bureau's equipment, supplied by the International Cooperation Administration. This may provide a fuel for generating low-cost power which would, in turn, give impetus to the Madras area for expanding industrialization. It has long been hampered by a lack of nearby fuel supply; currently, coal is imported 1,500 miles by rail.

MONGOLIA—The U.S.S.R. is reported to have agreed to carry out an integrated geological prospecting program in 1958-1960 for ores and non-metallic minerals in Mongolia. Equipment and technicians will be supplied, and a grant of credit up to 200,000,000 roubles will be extended "on easy terms." A joint Soviet-Mongolian firm called *Soomongolmetal* may revert completely to Mongolian control after repayment to the Soviet Union of the value of its share in the company. Repayment is scheduled to start in 1962 and to extend over a 30-year period.

INDIA—The area around Kolari in the Umner tahsil of Nagpur district, Bombay state, has been found to contain deposits of chromite, copper, gold, iron, and antimony ore. Copper and gold occurrences have been found for the first time. The government of India intends to undertake geo-chemical prospecting of the entire region. A geophysical survey has also been recommended.

MALAYA—*Puket Tin Dredging Ltd.* is now nearing the end of its reserves and it is estimated that dredging operations will cease in the early part of 1958.



EUROPE

SPAIN—Development of the *Solana* iron property in the province of Almeria has been undertaken by *Cia. Omnitum Minera Latin S. A.* of Madrid. The property was worked by an English-Spanish company until 1910 and geological explorations have proven a reserve of approximately 15,000,000 tons of magnetite ore with an iron content ranging from 40 to 56 percent. Ore will be transported by truck and rail to the port of Hornillos, 50 miles away, and shipped from there to Germany and Italy. Development work is being done by E. H. Kruenert, Consulting Engineers.

FINLAND—Discovery of large nickel deposits in the vicinity of Kotalathi, approximately 20 miles from Kuopio, was announced recently by the government copper mining company, *Outokumpu OY*. The ore body is situated about 650 feet beneath the surface and is considered to be one of the most important nickel deposits in Europe. Outokumpu is mining in three shifts and continuing exploration.

YUGOSLAVIA—Bauxite production is expected to total 927,000 metric tons in 1957, with Niksic producing 220,000 metric tons; Mostar, 237,000 metric tons; Drniš, 213,000 metric tons; Rovinj, 200,000 metric tons; Bosanska Krupa, 47,000

metric tons, and Risan, 10,000 metric tons. The local market will use 150,000 tons and 600,000 tons will be exported. Installation of additional mining equipment is planned to develop Yugoslavia's vast bauxite reserves. Near Zadar, for example, 6,000,000 tons of bauxite ore are reported; near Makarska, up to 2,500,000 tons, and near Jajce 1,200,000 tons are estimated.

ITALY—Aluminum production totalled 32,000 tons during the first six months of 1957 as compared with 29,000 tons during the same period last year. Bauxite production, however, has dropped from 121,000 tons in the first half of 1956 to 114,000 tons during the same period this year.

PORTUGAL—*International Refining Company, Ltd.* of Great Britain has obtained rights concerning uranium-bearing properties near Lisbon, but the question of who has the right to mine the property remains unsettled. According to recent reports, the ore is now being mined by local Portuguese.

GREECE—*The American-Austrian Magnesite Company* has made an agreement with the Greek government to take over operations at the magnesite mine in Vavdos-Chalcidice. The mine is expected to produce approximately 5,000 tons of chrome ore yearly, in addition to 23,000 tons of magnesite. Improvement of facilities and installation of an electric furnace is underway.

GERMANY—Expansion of the *Stolberger Zinc AG*'s lead smelter at Binsfeldhamer has been completed and the plant can now produce 50,000 metric tons of metal annually as compared to 35,000 tons previously produced. The new plant is almost completely automatic. Stolberger mines do not produce enough ore to keep the new smelter at capacity production and large amounts of concentrates are imported from Sweden, Greenland, Turkey, South America, North Africa, and Australia.

SPAIN—A group of Spanish metal producers are planning to build two copper smelters, one at Barcelona and one at Bilbao, according to recent reports. The *Duisburger Kupferhutte* of Germany will advise on the construction of the smelters and process to be used but will not assist financially. Production is scheduled to begin in 1959.

AUSTRIA—Overall mineral production has increased considerably in the first half of 1957 as compared with the same period in 1956. Iron ore output increased 11 percent; copper production increased from 73,700 tons in 1956 to 83,000 tons in 1957; lead and zinc production for the first half of this year set a new record with a total of 91,300 tons produced. Gypsum output for 1957 was 197,500 compared with 117,700 tons for the same period in 1956 and bauxite production was increased 800 tons. Production of crude graphite talcum remained about the same.

RUSSIA—During the first six months of 1957 Russian output of iron and steel, non-ferrous metals, and iron ore showed an increase as compared with production for the same period last year. According to the Russian method of showing increases by percentage, iron and steel production was 106 percent of last year's production; non-ferrous metals, 106 percent; and iron ore, 4,300,000 tons or 103 percent of ore produced in the first half of 1956. Although no figures were re-

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leased, increased production of aluminum, lead, and zinc was also reported. Part of this increase was attributed to modernization and expansion of mining and processing equipment and the introduction of advanced technology. New type drills are being used in the iron ore industry which increase the productivity of drillers by half as much again; new boring machines have been developed that make it possible to mechanize drilling when mining hard ores; and at the majority of mines in the Krivoy Rog district new scraper winches and large-capacity skips have been installed. In the iron and steel industry the process of melting steel in converters with the use of oxygen is now in use. Light, economical sections for rolled metal and tubes have been developed and new types of alloys and a larger variety of steel are being produced.

ITALY—The existence of about 10,000,000 tons of sulphur-bearing ore has been discovered a few miles south of Rome. The deposit is said to cover an area of about two miles near Pomezia. Drilling is being carried out.

PORUGAL—The *Portuguese-American Tin Company* which dredges for tin near Belmonte, Portugal, has now become a division of the *Yuba Consolidated Industries, Inc.* and hereafter will be known as the *Portuguese-American Tin Company Division*.

WEST GERMANY—West Germany increased its iron ore imports last year to 17,800,000 metric tons from 14,300,000 in 1955. Canada supplied 1,445,000 tons of this, making her third in the list of suppliers to Germany; in 1951 she had been only ninth, sending 146,000 tons. West Germany's steel output in 1956 increased 9 percent, reaching 23,200,000 tons, nearly 10 percent of the world's total. An 8 percent increase to 25,000,000 tons is expected.

YUGOSLAVIA—The *Majdanpek* copper and pyrite mines are being expanded through loans from France and the United States. It is reported that France will provide a long-term credit of \$40,000,000, while the United States will lend \$15,000,000 at 5 percent interest.

U.S.S.R.—A major copper deposit is reported to be under development in the Urup area of the Transcaucasus.

FINLAND—*Otanmaki Company* will spend 16,500,000 Finnish Marks over the next four or five years to build an iron and steel plant in northern Finland. The project will include a pig iron plant with a capacity of 115,000 metric tons annually, a steel melting shop with a capacity of 135,000 tons of ingots annually, and a heavy and medium plate mill with an annual capacity of 100,000 tons of finished plate. Future plans include construction of a steel rolling mill and additional steel making capacity (converter) at a later date. The company operates the largest iron mine in the country. Mining started in 1951, and normal production of 500,000 to 800,000 tons of ore was reached in the latter part of 1954. This corresponds to about 250,000 tons of combined magnetite and ilmenite concentrates. The Finnish government has been stressing the need for higher steel production for some time. The country's leading steel producer, *Osakeyhti Vuokkenniska*, is to build a 250,000 ton (annually) steel plant which will treat ore from the *Nyham* and *Jussaro* deposits.

*

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Electrolytic, Delivered F.o.b. cars, Valley basis

October 15, 1957

27.00¢

Lake, Delivered, destination, U.S.A. 27.00¢

27.00¢

Foreign Copper, Valley basis 26.00¢

26.00¢

LEAD:

Common Grade, New York 13.50¢

ZINC:

Prime Western, F.o.b. E. St. Louis 10.00¢

ALUMINUM:

Antimony, F.o.b. shipping points 55.00¢

BISMUTH:

Cadmium, F.o.b. shipping points 28.10¢

COBALT:

Columbium, F.o.b. shipping points 33.50¢

GERMANIUM:

Lithium, F.o.b. shipping points 52.25¢

MAGNESIUM:

Mercury, F.o.b. shipping points 1.70¢

NICKEL:

Plutonium, F.o.b. shipping points 2.00¢

SELENIUM:

Thorium, F.o.b. shipping points Nom., per pound \$120.00

TIN:

Titanium, F.o.b. shipping points 24.00¢-30.00¢

URANIUM:

U-235, F.o.b. shipping points 51.00¢-14.00¢

GOLD:

Silver, F.o.b. shipping points 82.00¢

PLATINUM:

Zirconium, F.o.b. shipping points 36.00¢

CHROME ORE:

Beryllium ORE, F.o.b. mine, Colorado \$46.00 per unit

CHROME ORE:

Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at \$40.00 per short ton or by assaying at: 8.0 to 8.9% BeO, \$40 per unit; 9.0 to 9.9%, \$45; over 10.0%, \$50.

BERYLLO ORE:

F.o.b. railroad cars eastern seaports. Long tons dry weight.

CHROME ORE:

African (Rhodesian), 48% Cr₂O₃, 3 to 1 Ratio \$50.00-\$52.00

CHROME ORE:

African (Transvaal), 48% Cr₂O₃, No ratio \$37.00-\$38.00

CHROME ORE:

Turkish, 48% Cr₂O₃ to 1 chrome-iron ratio \$55.00

CHROME ORE:

U. S. Government ore purchase depot Grants Pass, Oregon, Base price, lumpy ore, \$115.00; fines and concentrates \$110.00 for 48% Cr₂O₃ and a 3 to 1 chromium-iron ratio. Premiums for higher grade are and for a ratio up to 3.5 to 1. Penalties for grades down to 42% Cr₂O₃.

CHROME ORE:

At United States small lot beryl purchase depots. \$3.40 per pound contained combined pentoxides in 50% ore. Includes 100% bonus. (Government stopped buying temporarily May 12)

IRON ORE:

Per Pound Pentoxide. 1.15-1.35

IRON ORE:

Lake Superior, Per gross ton Lower Lake Ports \$11.45

IRON ORE:

Mesabi, Non Bessemer, 51.5% Fe \$11.60

IRON ORE:

Mesabi, Bessemer, 51.5% Fe \$11.70

IRON ORE:

Old Range Non Bessemer \$11.85

IRON ORE:

Old Range Bessemer. 26.00¢

IRON ORE:

Swedish, Atlantic Ports, 60 to 68% Fe Contracts, Per Unit \$1.40-\$1.45

IRON ORE:

Metallurgical grade, 48 to 50% Mn, Long ton unit \$1.35-\$1.40

IRON ORE:

Metallurgical grade, 46 to 48% Mn, Long ton unit \$1.30-\$1.35

IRON ORE:

Domestic U. S. Government ore purchasing depots: Butte, Montana; (black and pink ores) base price of \$4.87 per long dry ton of 18% manganese ore Phillipsburg, Montana; base price of \$6.43 per long ton of 15% manganese ore. Small lot program f.o.b. railroad cars, minimum 40% Mn. Base price (48%) \$2.30 per unit with premiums and penalties.

IRON ORE:

90% MoS, F.o.b. Climax, Colorado. Per pounds of contained molybdenum, plus cost of containers \$1.18

IRON ORE:

Domestic, 60% WO₃ Per short ton unit Government not buying \$55.00

IRON ORE:

Foreign, 65% WO₃ Per short ton unit (Schedule) \$15.00

IRON ORE:

Foreign, South American, Spanish, Portuguese \$14.00

IRON ORE:

Carnotite-Roscoelite, F.o.b. purchase depot or company mill plus \$0.06 per ton mile (\$6.00 maximum), Grand Junction, Rifle, Durango, Naturita and Uravan, Colorado, Salt Lake City, Marysvale, Thompsons, Yucca, Green River, Mexican Hat, and Monticello, Utah, Shiprock, and Grants, New Mexico, Edgemont, Dakota, Jeffrey City, Wyoming, Ute City, Arizona, Base price for 0.10% V₂O₅ is \$1.50 per pound and up to \$3.50 per pound for each in excess of 10 pounds. \$0.50 per pound development allowance paid on all ore purchases. Special time schedule applies at Monticello, Moab and Grants. No lime penalty with no vanadium payment or lime penalty with vanadium payment.

IRON ORE:

Carnotite-Roscoelite, V₂O₅ in ratio of more than 10 parts to 1 part of U₃O₈ are generally acceptable at all AFC depots, but excess not paid for at Marysvale, Monticello, and Bluewater. Shiprock has no limit on V₂O₅ to U₃O₈ ratio and all contained V₂O₅ is paid for \$0.31

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PERLITE:

Mexican, 70% F.o.b. border \$24.00-\$24.50

SULPHUR:

Acid Grade, 97% CaF₂, Bulk, F.o.b. Kentucky, Illinois, Colorado \$47.00-\$50.00

SULPHUR:

Government buying F.o.b. producer's shipping point: 60% Illinois-Kentucky, \$34.50 per ton, others \$28.50; 70% Ill.-Ken. \$38.50, others \$32.50.

SULPHUR:

Crude: F.o.b. mine per short ton \$3.00 to \$5.00

SULPHUR:

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SULPHUR:

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SULPHUR:

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October 15, 1957
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COPPER:	Electrolytic spot £182	10s Od 22.81¢
LEAD:	Refined 99% £84	10s Od 10.56¢
ZINC:	Virgin, 98% £67	15s Od 8.47¢
ALUMINUM:	Ingots, 99.5% £197	0s Od 24.62¢*
ANTIMONY:	Regulus, 99.6% £222	10s Od 27.81¢*
TIN:	Standard, 99.75% £730	0s Od 91.25¢
TUNGSTEN:	Long ton unit 115s	With Sterling pound at \$2.80 £13.80

Quotations on metals and certain ores through the courtesy of *American Metal Market*, New York, N. Y.

Crooks Gap

Continued from page 57

general accumulation in the entire sedimentary channel area. The importance of carbon to the original uranium deposition may now be masked by later solution, transportation, and precipitation of uranium by ground waters. The tension faults, although not specific localizers of uranium, are nevertheless more abundant in the highly mineralized parts of the district and therefore important.

Origin: The origin of these deposits is believed to be confused by ground water solution and transportation. The writer believes the uranium was originally introduced by very low-temperature hydrothermal solutions associated with the major thrust fault. Evidence of this mineralization exists in the Chugwater-Cody fault contact on Wyoming Uranium's Beatrice claims and in the pre-Cambrian-Cambrian fault contact on Mountain Mesa Uranium's claims in Section 9.

Ground water later dissolved much of the uranium in the thrust fault zone and transported it to the favorable sites of deposition throughout the Wasatch formation. Erosion of the older beds in the thrust fault area at the same time the Wasatch material was being deposited would have liberated con-

siderable amounts of uranium into ground water channels. This would all imply a Laramee age for the primary mineralization, but as has been indicated by Van Houten⁶, the Laramee orogeny in this part of Wyoming continued into early Eocene or Wasatch time. Therefore, it is believed that feeble hydrothermal solutions may have permeated the Wasatch as well, although the various superimposed ore zones at various elevations (See Figure 3), with the indefinite lithologic favorability, seem best explained by a fluctuating water table with deposition of uranium at static positions in the water table cycle. The possibility should also be mentioned that some uranium could have been leached from the radioactive Sweetwater granite which was eroded to form the Wasatch and Wind River formations.

Uranophane, autunite, and other minerals are found along the thrust faults. Exploration has been limited and has not penetrated deep enough to find primary mineralization.

Exploration Procedures

Geological: A study of aerial photographs, both in the office and field, is very helpful in locating the tension-faulted areas. Although detailed geological mapping is not as important

here as in many districts, semi-detailed mapping (1 inch = 200 foot scale) is nevertheless recommended primarily to define the extent of each formation and to map other visible geological features. Radiometric grid surveys are very useful for general location of favorable areas, although subsurface ore bodies cannot always be delimited. A radiometric high will usually be present above or near an ore body if less than 100 feet deep, but its configuration is not necessarily related to the shape of the ore body. With a few hundred feet of cover, radiometrics are not reliable except if the mineralized zone outcrops around a hill. A high can usually be obtained in these cases, even if the outcrop is very feeble or not visible because of grass and sagebrush cover. Contouring of results is necessary to delineate a trend, as random radiometric readings are difficult to interpret.

Type of Drills: Standard rotary drills of the Failing, Mayhew, and Winter-Weiss types are the cheapest and best to use for initial exploratory drilling. Adequate dust collectors for sample recovery are very important, as considerable uranium may escape in the very fine dust. When the water table is reached, drilling with water must be resorted to. A drill should be

Continued on next page

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equipped for coring, as occasional cores are necessary for stratigraphic data, although core recovery has been notably poor throughout the district.

Phelps Dodge used churn drilling for accurate grade control in mineralized areas found by more rapid rotary drilling. This constitutes a new approach to uranium drilling and has proved successful, because none of the sample is lost, such as is always the case, to varying degrees, in rotary drilling, and no significant amounts of uranium are lost by solution in the drilling water. The chief disadvantage is the slowness. The higher cost is no disadvantage when accurate grade control is obtained.

Sample Collection and Logging: When dry drilling above the water table, sample collection is simple if utilizing the dust collectors which are standard with most rotary drills. Samples can be stacked in orderly piles and marked for geological logging and collection for assay. After the geologist has logged the cuttings and the hole has been probed, those piles from interesting zones can be collected and sent for assay.

With water drilling, sample collection becomes a problem. A suitable metal trough should be constructed to collect the entire sample from a drilling interval, usually two to three feet. Most of the solid material can then be shoveled out of the trough and utilized for logging and for assays. The wet samples are more unreliable than the dry ones for assaying, but the lithologies can be adequately logged. The exception to this is when mud is needed, to avoid a lost hole; the mud contaminates and renders samples nearly useless for any purpose.

Acknowledgements

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THE END

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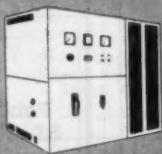
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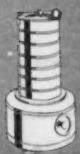
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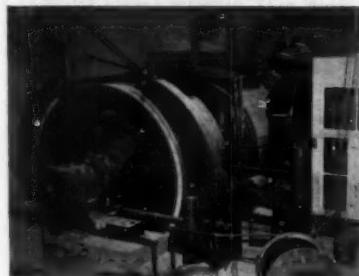
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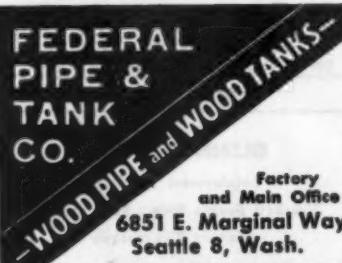
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- 1—150 KW GE, 125 V. 1200 RPM, 2300/4000

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2-500 Gram Denver Lab Flotation Cells
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1-Ingersoll-Rand model HU
1-Gardner-Denver model HM

JAW CRUSHERS

1-9" x 15" Wheeling jaw crusher
1-9" x 24" Cedar Rapids jaw crusher
1-20" x 36" Austin-Western jaw crusher

ELECTRIC SLUSHERS

1-5 HP Brownie tucker model HG
1-5 HP Sullivan tucker model DE
2-7½ HP Sullivan tuggers, model HE
5-5 HP Sullivan 2 drum model HDE
1-10 HP Sullivan 3 drum model HDE-10
1-15 HP Joy 2 drum model AF-212
2-20 HP Ingersoll-Rand 2 drum model 20NM
1-50 HP Sullivan 2 drum model CF-211

ORE CARS

11-15 cu. ft. rotary end dump, 18" ga.
14-18 cu. ft. rotary end dump, 18" ga.
1-20 cu. ft. rotary end dump, 18" ga.
3-21 cu. ft. rotary end dump, 18" ga.
3-26 cu. ft. Card Grandby type cars, 24" ga.
3-27 cu. ft. Koppel rocker dump cars, 24" ga.
6-54 cu. ft. Koppel rocker dump cars, 36" ga.
12-84 cu. ft. Truxx rocker dump cars, 36" ga.

LOADERS

2-12-B Eimco loaders
1-21 Eimco loader

DRILLING EQUIPMENT

3-Atlas jackhammers, model RH-636-4W with air legs
4-Ingersoll-Rand jackhammers model X-38
1-Thor sinker, model 38
2-Barco model H-6 paving breakers, gas engine driven
1-Gardner-Denver paving breaker model B-67
1-Gardner-Denver paving breaker model B-67
4-Gardner-Denver self rotating stoppers model R-104

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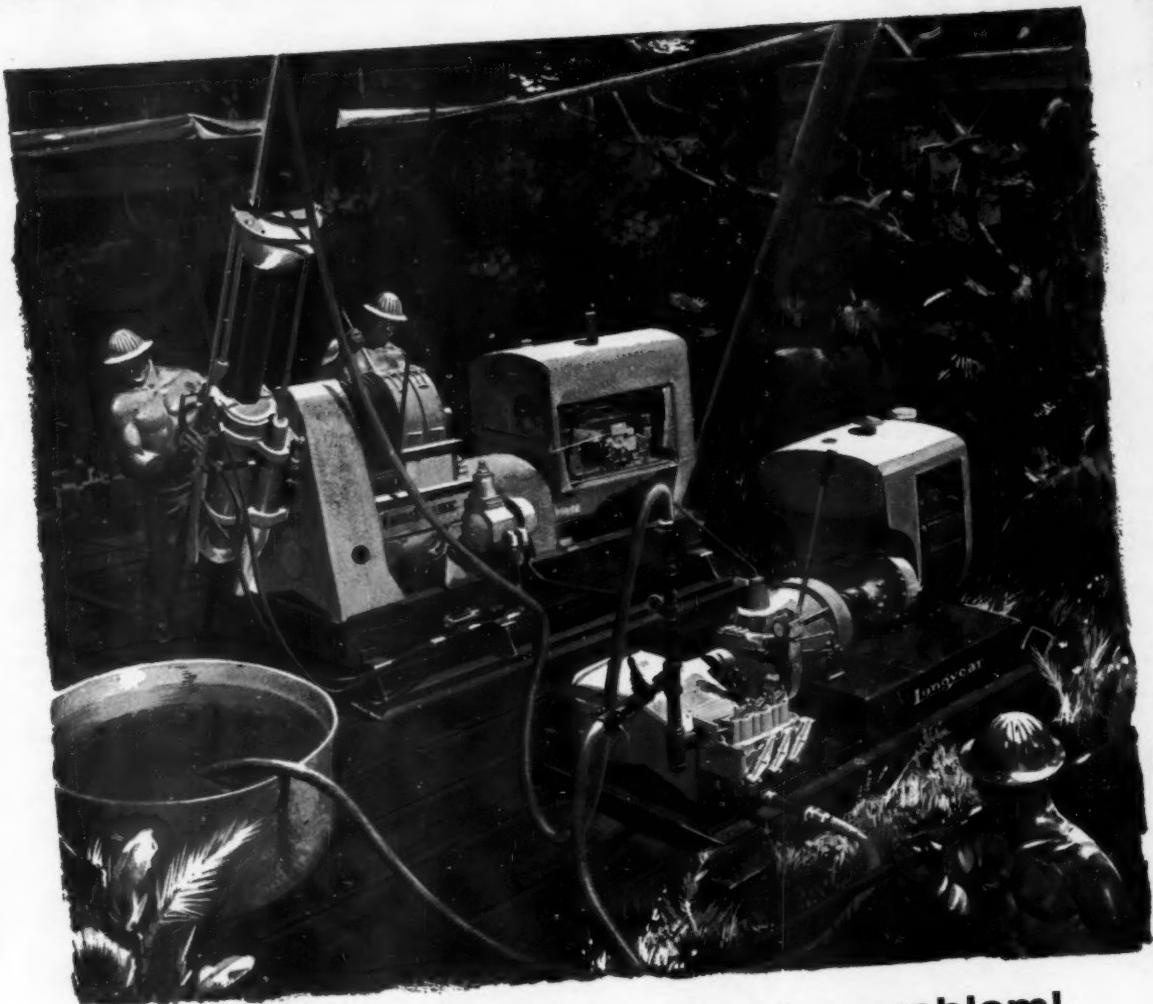
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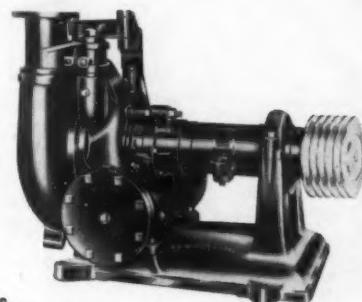
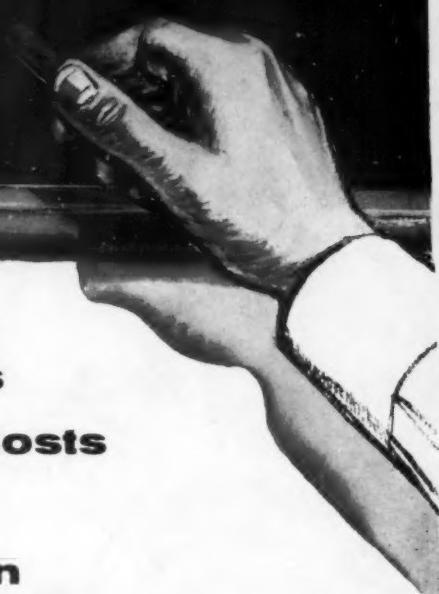
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